

Figure 1

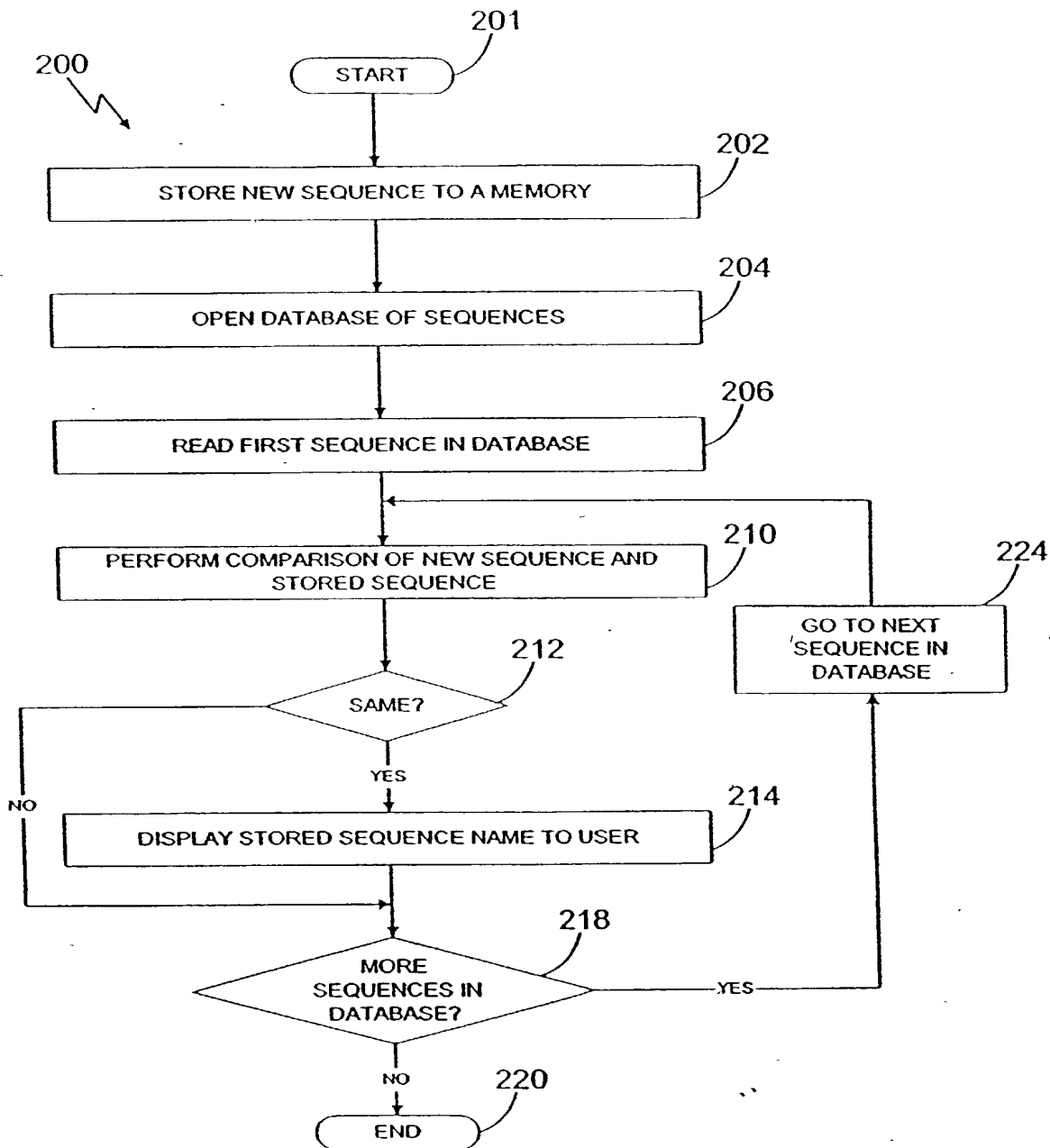


Figure 2

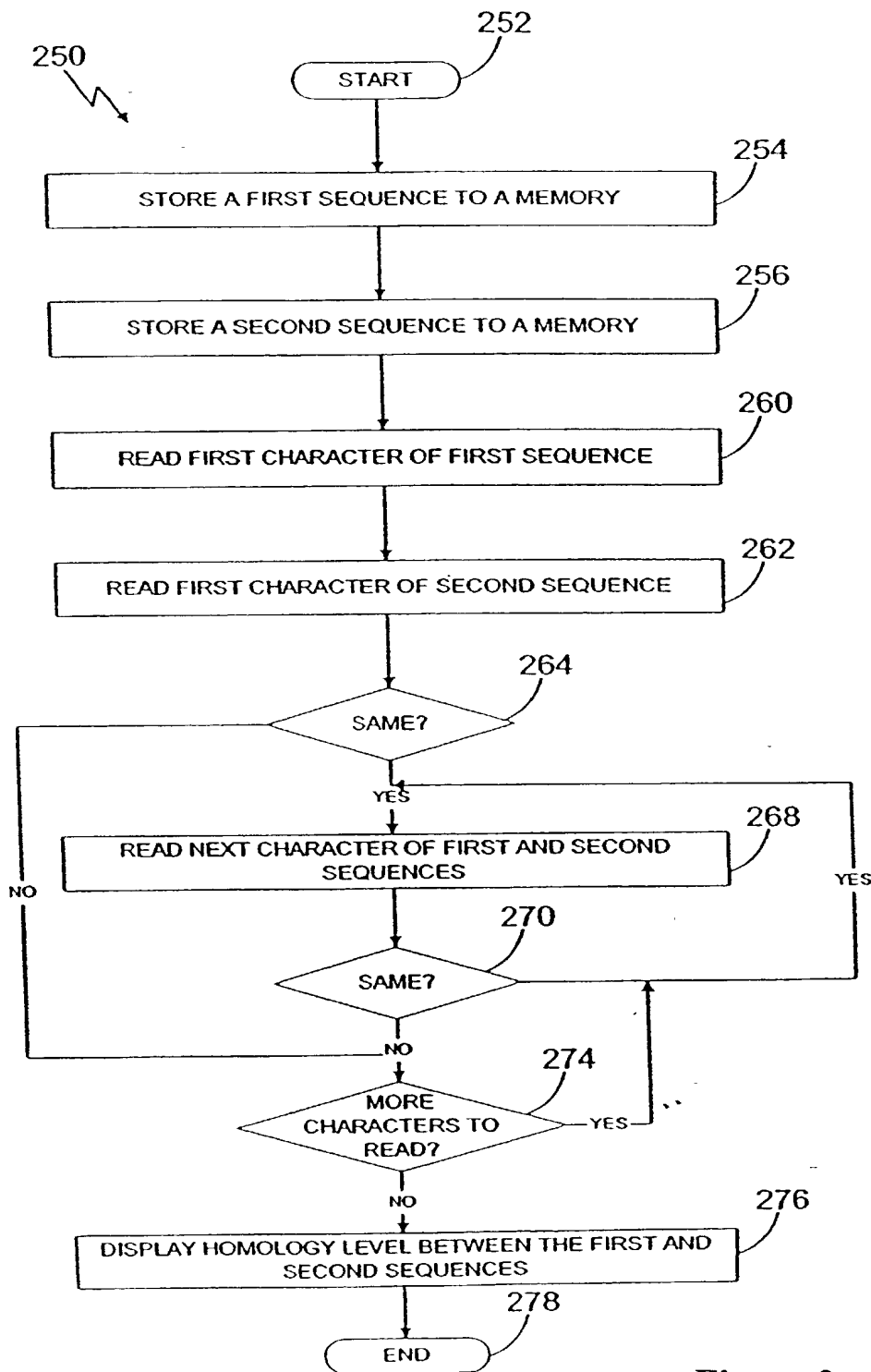


Figure 3

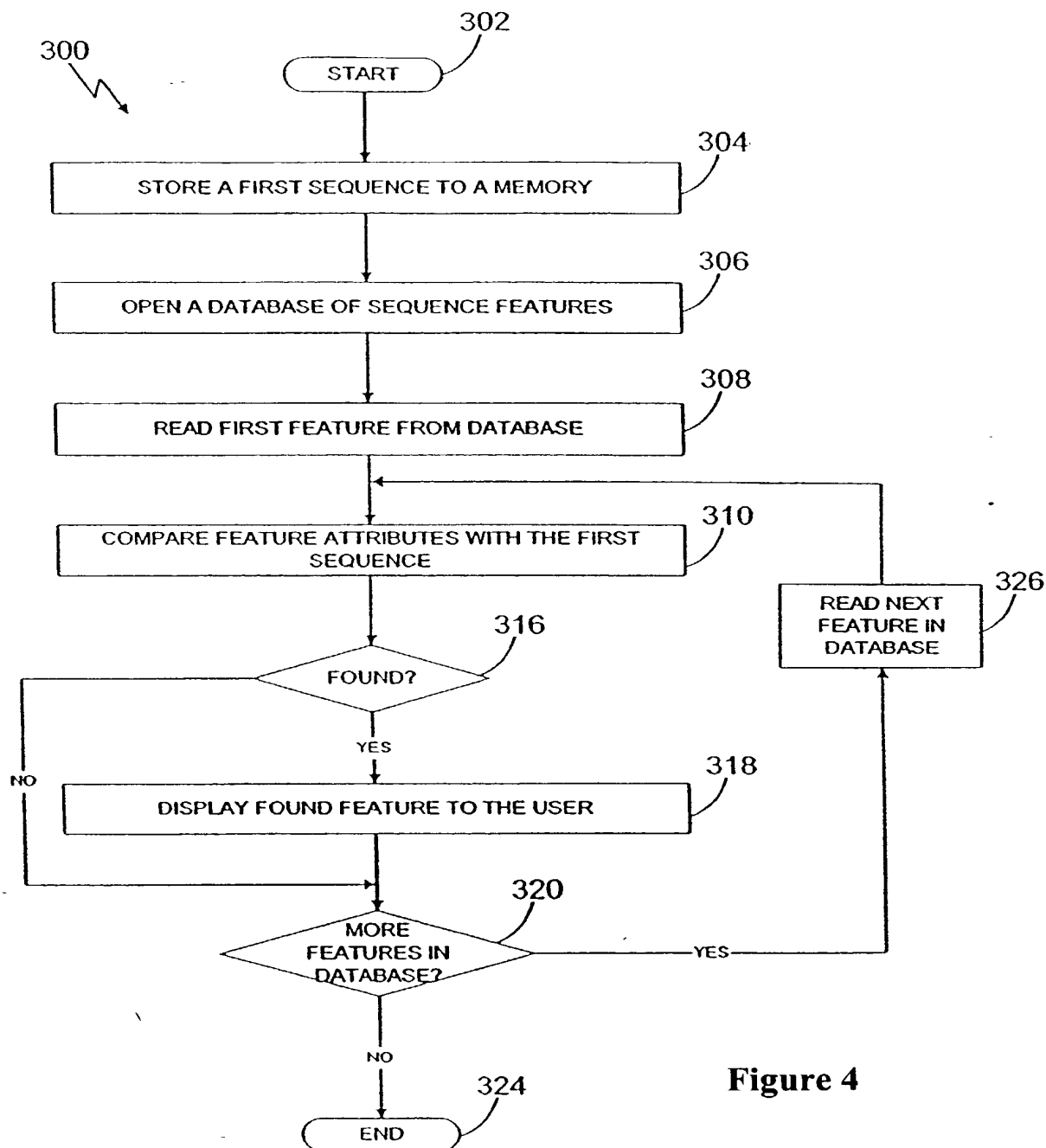


Figure 4

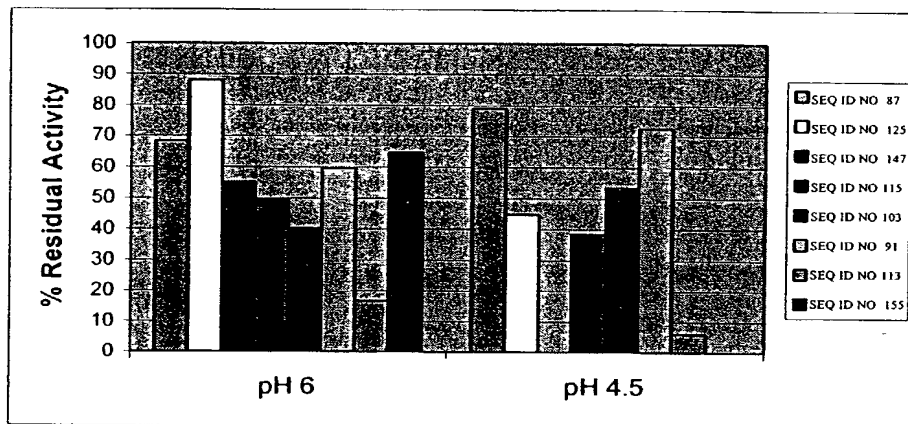
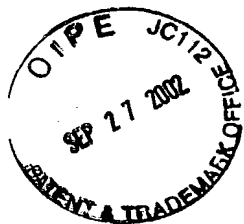


Figure 5: Residual activity of various amylases following heating to 90°C for 10 min.

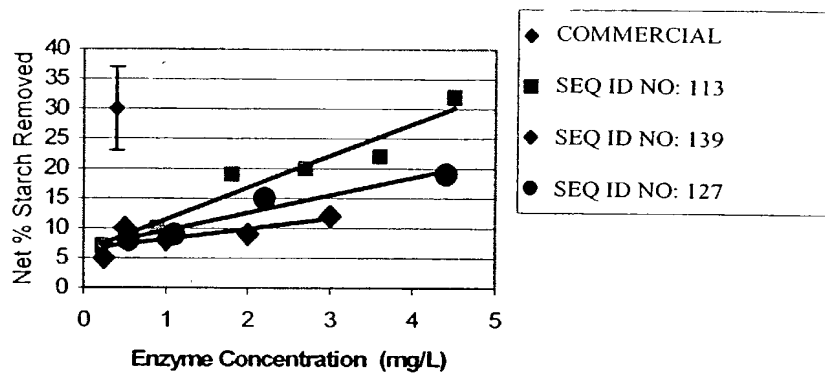
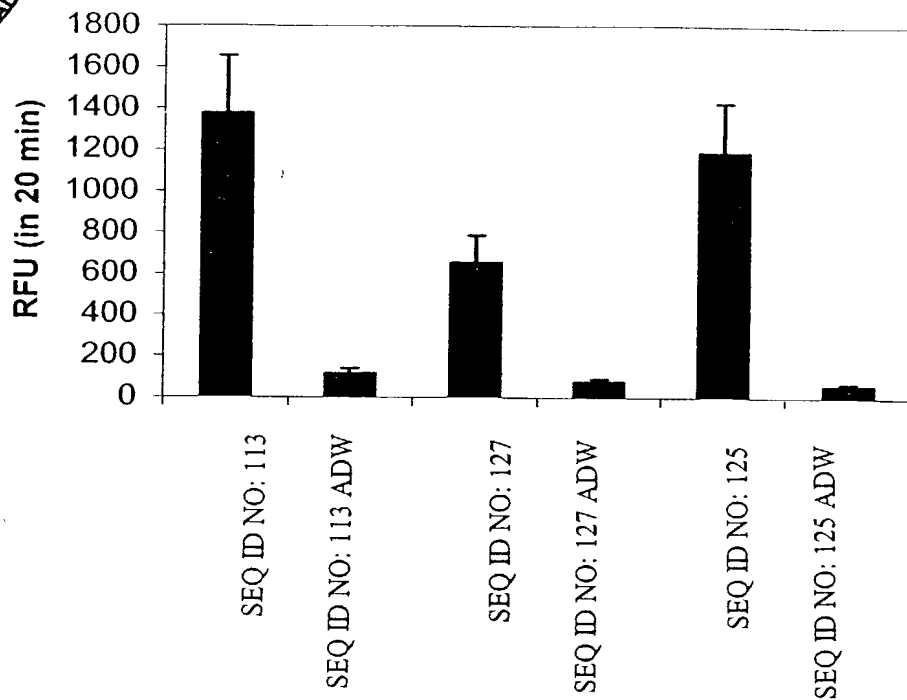


Figure 6. Net percent starch removed vs. enzyme concentration in ADW wash test with bleach and chelators

Figure 7: Activity of parental amylases at pH 8, 40°C (black bars) in ADW formulation at 25°C (gray bars). Values are the average of 384 wells with error bars representing the standard deviation.



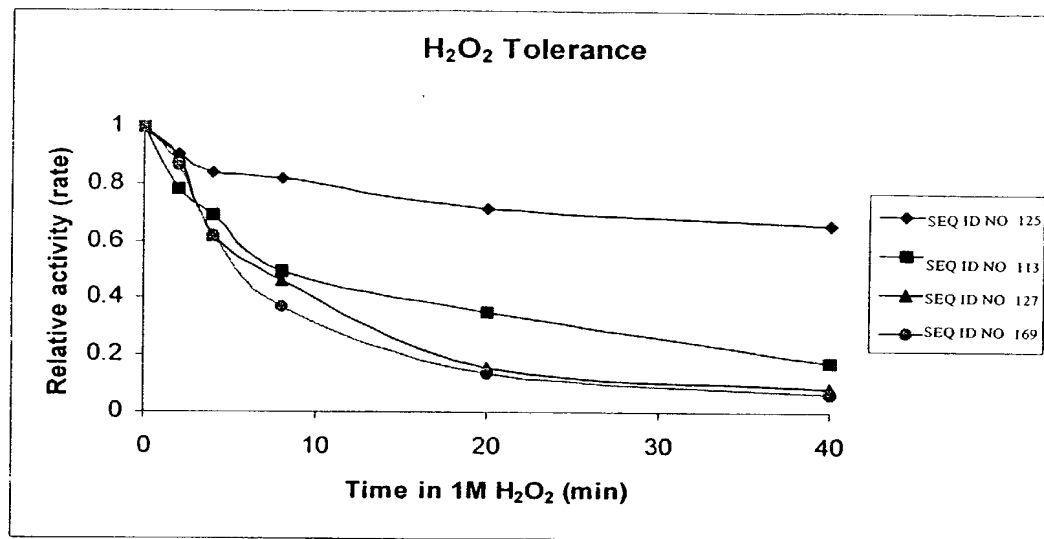


Figure 8

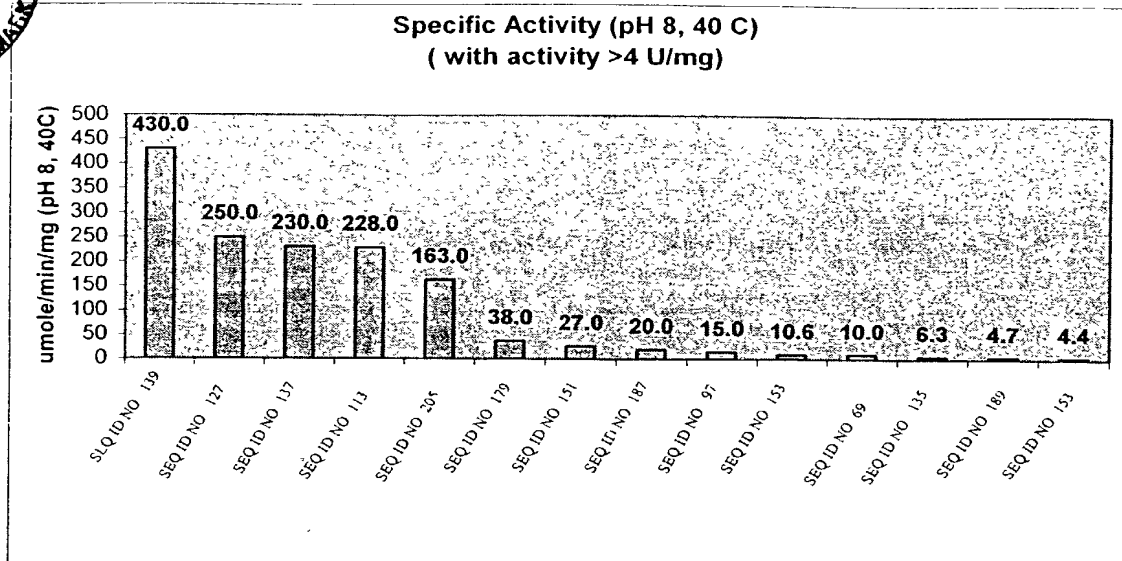


Figure 9A

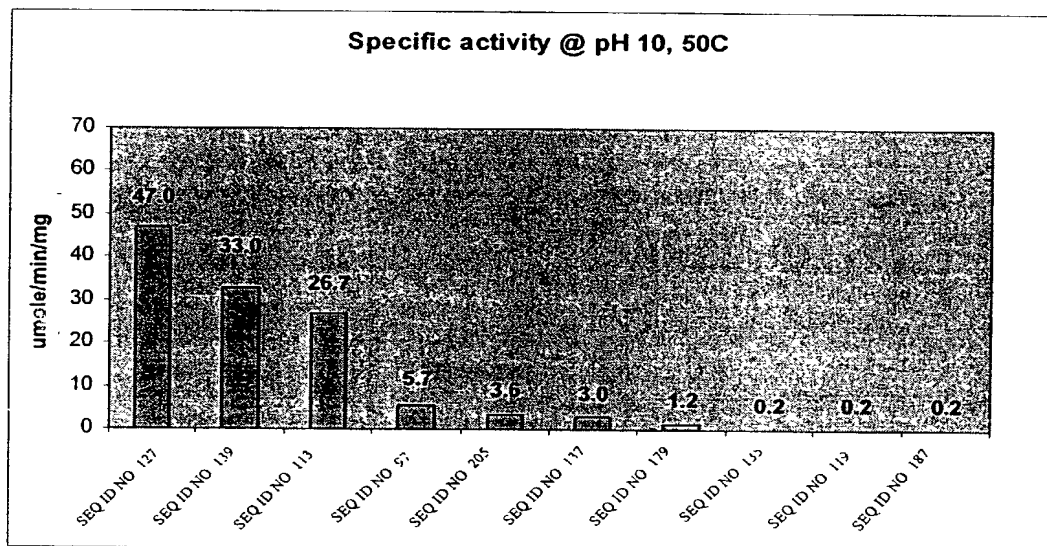


Figure 9B



Figure 10: Alignments of the genes proposed to be used in reassembly

```

1
SEQ ID NO:114 (AA 29-512) (1) -----AANLNGTLMQYFEWYMPNDGQHWKREQND SAYLAEHGITAVWIPPAYKGTGTS-QADVGYGAYDLYDLGEFHQKGTVR 80
SEQ ID NO:128 (AA 31-615) (1) -QANTAPVNGTMMQYFEWDLPN DGTLTWKVNEASSLSL GITALWLPAYKGTGTS-QGDVGYGVYDLYDLGEFQKGTIR
SEQ ID NO:116 (AA 2-437) (1) AKYSELEQGGVIMQAFYWDVPEGGIWDWTIRKIP EWYDAGISAIWIPFASKMGGAYSMGYDPDYDFDLGEFYQKGTVE

81
SEQ ID NO:114 (76) TKYGTGKGLQSAIFSLHSRDIN VYGDVVINHKGGADATEDVTAVEVDPADRNHVISGEHRKAWTHFHFPGRGSTYSDFK 160
SEQ ID NO:128 (79) TKYGTGKTVLQAIQAASAGHQVYADVVFNHKGAGADSTEWDAVEVNP SNRQETSQTYQIQAWTKFDFPGRGNTYSSEK
SEQ ID NO:116 (81) TRFGSKKEELVNMESTAHGYGIRKVIADIVINERAGGDLEWNPYVGDYTWTFDSKVASGKYKAHYMDFIPN-----

161
SEQ ID NO:114 (156) WHWYHFDGTDWDESRLNRIYKFG--KAWDWEVSNENGN DYLMYADIDYDHPDVAAEIKRWGTWYANELQLDGFRLLDA 240
SEQ ID NO:128 (159) WRWYHFDGTDWDESRLNRIYKFRGTGKAWDWEVDTE NGNYDLYMADLMDHPVVTELKNWGTWYVNTTVDGFRLLDA
SEQ ID NO:116 (150) ----NYSTSDGTFGGFPDIDELVPFNQYWLWASNES-----YAYLRSIGIDAWRFDY

241
SEQ ID NO:114 (234) VKHIKESFLRDWVNVHREKTGKEMFTVAEYVNDLGALENYL NKTNFNHSHVFDVPLHYQFHAASTQGGGYDMRKLLNG-- 320
SEQ ID NO:128 (239) VKHIKYSFFPDNLTHVRSQTRKNLFAVGGEFWSYDVNKEH NYITKTSGTMSLEFADPLHNNFYTASKSSGYFDMRYLLNN--
SEQ ID NO:116 (200) VKGYGAWVVKDNLSCWGG-----WAVGEYVWCTNVDALLN WAYS SG--AKVFDFPLLYKMD EAFDNKNIPALVYAIQNGE

321
SEQ ID NO:114 (312) TVVSKHFLKAVIFVDNHDTPGQSLESTVCTWFKPLAYAFETI TRESGYEQVFGDLMYGTKGDSQ--REIPALKHKHKEPTL 400
SEQ ID NO:128 (317) TLMKDOBSLAVTLVDNHDTPGQSLQSWEPWFKPLAYAFETI TRCEGYHCVEYGEHYGIPKYN----IPGLKSKIDPLL
SEQ ID NO:116 (272) TVVSRDFKAVTFVANHDTP-----IIWNKYPAYAFETI TYE-GQEVLEHYRQYEEWLNKD-----KLNNL---I

401
SEQ ID NO:114 (390) KARKQYAYGAQH DYFDHHDIVGWTRREGDSSVANSGLAALITD GPGGAKRMYVGRONAGETWHDITGNRS--EPVVINSEG 480
SEQ ID NO:128 (392) IARRDYAYGTORDYIDHODIIGWTRREGIDSKPNSGLAALITD GPGGSKWMYVQKKHAGKVFYDITGNRS--DTVTINADG
SEQ ID NO:116 (331) WIHEHLAGGSTRI LYDDDELIEMREGYGERPGL-ITYINLGSDWAE RWVNVGSKFAGYTIHEYTGNLGGWVDRYVQYDG

481
SEQ ID NO:114 (468) WGEFHVN-----GGSVSIYVQR----- 560
SEQ ID NO:128 (470) WGEFKVN-----GGSVSIYVAKTSQVTFVNNATTISGQNVYV VGNIPELGNWNTANA I KMT PSSYPTWKATIALP
SEQ ID NO:116 (410) WVKLTAPPHDFPANGYGYGYSYWSYAGVG-----

561
SEQ ID NO:114 (485) ----- 605
SEQ ID NO:128 (541) QGKAIEFKFIKKDQSGNVVWESI PNRTYTVFPLSTG SYTASWNVP
SEQ ID NO:116 (437) -----
```



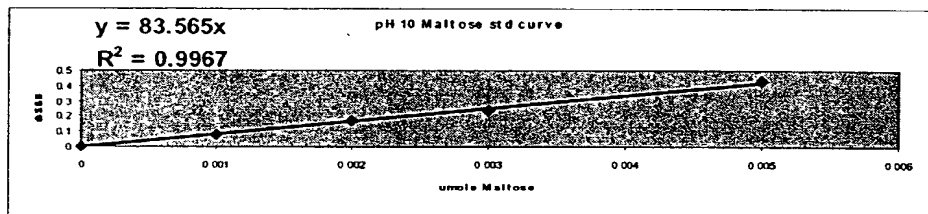
Appln No.: 10/081,872

Applicant(s): Walter Callen et al.

ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

Page 11 of 116

Figure 11: Example Standard Curve of the assay of Example 5.



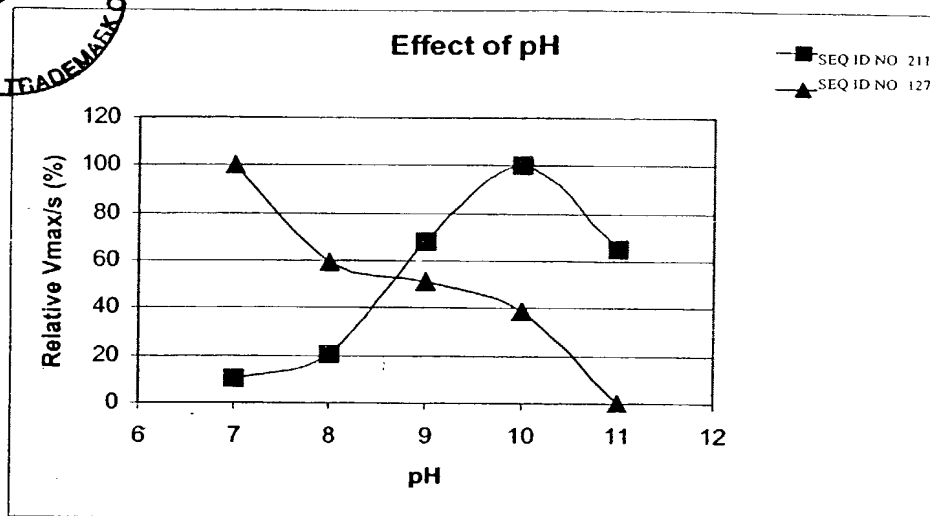


Figure 12: A graph of the pH rate profiles for 2 different amylases. BD7188 is a control; an enzyme that was discovered previously and has a neutral pH optimum. BD7837 is a more recently discovered amylase and has an optimum around pH 10. Pure protein was used in these assays.



Appln No.: 10/081,872

Page 13 of 116

Applicant(s): Walter Callen et al.

ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

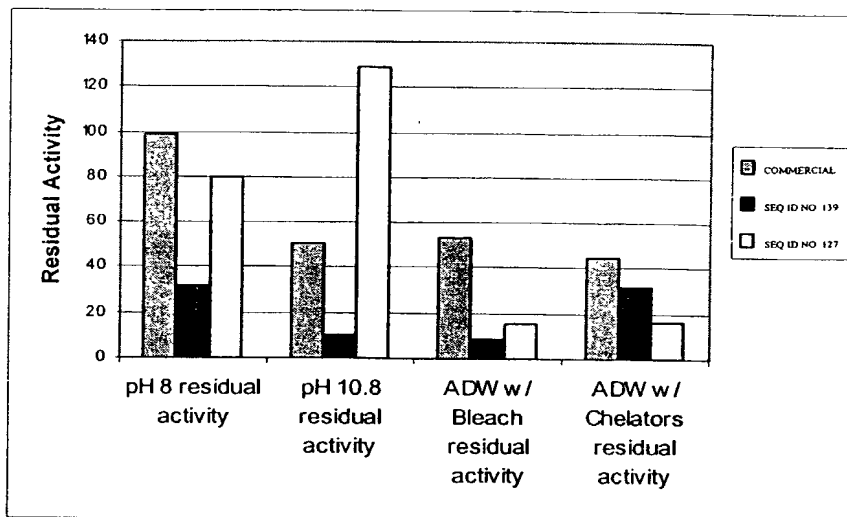


Figure 13: Stability of Diversa amylases vs. a commercial enzyme



1 50
SEQ ID NO 82 -----MKK FVALFITMFF VVSMVV... ..AQPASAAK
pyro (SEQ ID NO:313) -----MKK FVALLITMFF VVSMVAV... ..AQPASAAK
pyro2 (SEQ ID NO 314) -----VNIKK LTPLLTL LLLF FI...VL... ..ASPVSAAK
thermo (SEQ ID NO 315) SESQCTATCT WRVVYMSAKK LLALLFVLAV LVGVAVIPAR VGIAPVSAGA
thermo2 (SEQ ID NO 316) -----MA RKVLVALLVF LVVLSVSAVP
Consensus (SEQ ID NO 317) -----SA--

51 100
SEQ ID NO 82 YS..ELEEKG VIMQAFYWDV PGGGIWWDTI RSKIPEWYEA GISAIWIPPA
pyro (SEQ ID NO 313) YS..ELEEKG VIMQAFYWDV PAGGIWWDTI RSKIPEWYEA GISAIWIPPA
pyro2 (SEQ ID NO:314) YL..ELEEKG VIMQAFYWDV PGGGIWWDHI RSKIPEWYEA GISAIWLPPP
thermo (SEQ ID NO:315) TSRRPSLEEG VIMQAFYWDV PAGGIWWDTI RSKIPDWSA GISAIWIPPA
thermo2 (SEQ ID NO 316) AKAETLENGG VIMQAFYWDV PGGGIWWDTI AQKIPDWSA GISAIWIPPA
Consensus (SEQ ID NO 317) -----LE-GG VIMQAFYWDV P-GGIWWD-I --KIP-W--A GISAIW-PP-
Sense primer

101 150
SEQ ID NO 82 SKGMSGGYSM GYDPYDFFDL GEYNQKGTIE TRFGSKQELI NMINTAHAYG
pyro (SEQ ID NO:313) SKMGGAYSM GYDPYDFFDL GEYNQKGTVE TRFGSKQELI NMINTAHAYG
pyro2 (SEQ ID NO 314) SKGMSGGYSM GYDPYDYFDL GEYYQKGTVE TRFGSKEELV RLIQTAHAYG
thermo (SEQ ID NO 315) SKGMSGAYSM GYDPYDFFDL GEYYQKGTVE TRFGSKQELI NMINTAHSG
thermo2 (SEQ ID NO:316) SKGMSGGYSM GYDPYDFFDL GEYYQKGSVE TRFGSKEELV NMINTAHAN
Consensus (SEQ ID NO 317) SKGM-G-YSM GYDPYD-FDL GEY-QKG--E TRFGSK-EL--I-TAH---

151 200
SEQ ID NO:82 IKVIADIVIN HRAGGDLEWN PFVGDYTD WTD FSKVASGKYT ANYLDFHPNE
pyro (SEQ ID NO 313) IKVIADIVIN HRAGGDLEWN PFVGDYTD WTD FSKVASGKYT ANYLDFHPNE
pyro2 (SEQ ID NO:314) IKVIADVVIN HRAGGDLEWN PFVGDYTD WTD FSKVASGKYT ANYLDFHPNE
thermo (SEQ ID NO 315) IKVIADIVIN HRAGGDLEWN PFTNSYTD WTD FSKVASGKYT ANYLDFHPNE
thermo2 (SEQ ID NO:316) MKVIADIVIN HRAGGDLEWN PFTNSYTD WTD FSKVASGKYT ANYLDFHPNE
Consensus (SEQ ID NO:317) -KVIAD-VIN HRAGGDLEWN PF---YTD WTD FSKVASGKYT ANYLDFHPNE

201 250
SEQ ID NO:82 VKCCDEGTFG GFDPDIAHEKS WDQHWLWASD ESYAAYLR SI GVDARWFDYV
pyro (SEQ ID NO:313) VKCCDEGTFG GFDPDIAHEKE WDQHWLWASD ESYAAYLR SI GVDARWFDYV
pyro2 (SEQ ID NO 314) LHCCDEGTFG GFDPDICHHE WDQYWLW KSN ESYAAYLR SI GFDGWRFDYV
thermo (SEQ ID NO:315) VKCCDEGTFG GFDPDIAHEKS WDQYWLWASQ KSYAAYLR SI GIDARWFDYV
thermo2 (SEQ ID NO:316) LHAGDSGTFG GYPDICHDKS WDQHWLWASN ESYAAYLR SI GIDARWFDYV
Consensus (SEQ ID NO:317) ----D-GTFG G-PDI-H-K- WDQ-WLW-S- -SYAAYLR SI G-D-WRFDYV

251 300
SEQ ID NO:82 KGYGA WVVKD WLNWWGGWAV GEYWDTN VDA LLNWAYSSGA KVFDFPLYK
pyro (SEQ ID NO:313) KGYGA WVVKD WLNWWGGWAV GEYWDTN VDA LLNWAYSSGA KVFDFPLYK
pyro2 (SEQ ID NO 314) KGYGA WVVVD WLNWWGGWAV GEYWDTN VDA LLSWAYESGA KVFDFPLYK
thermo (SEQ ID NO:315) KGYGA WVVKD WLKWW. ALAV GEYWDTN VDA LLNWAYSSGA KVFDFPLYK
thermo2 (SEQ ID NO:316) KGYAP WVVKN WLNRRWG WAV GEYWDTN VDA LLSWAYDSGA KVFDFPLYK
Consensus (SEQ ID NO:317) KGY--WVV-- WL--W--AV GEYWDTN VDA LL-WAY-SGA KVFDFPLYK

301 350
SEQ ID NO:82 MDEAFDNKNI PALVSA LQNG QTVVSRD PFK AVTFVANH DT DIIWNKYLA Y
pyro (SEQ ID NO:313) MDEAFDNTNI PALVDA LQNG GTVVSRD PFK AVTFVANH DT DIIWNKYPA Y
pyro2 (SEQ ID NO:314) MDEAFDNNNI PALVYA LQNG QTVVSRD PFK AVTFVANH DT DIIWNKYPA Y
thermo (SEQ ID NO:315) MDEAFDNKNI PALVSA LQNG QTVVSRD PFK AVTFVANH DT DIIWNKYPA Y
thermo2 (SEQ ID NO:316) MDEAFDNNNI PALVDA LKNG GTVVSRD PFK AVTFVANH DT NIIWNKYPA Y
Consensus (SEQ ID NO 317) MDEAFDN-NI PALV-A-L-NG -TVVSRD PFK AVTFVANH DT -IWNKY-A Y

Figure 14A-1



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000

SEQ ID NO 82
pyro (SEQ ID NO 313)
pyro2 (SEQ ID NO 314)
thermo (SEQ ID NO 315)
thermo2 (SEQ ID NO 316)
Consensus (SEQ ID NO 317)

```
351                                     400
AFILTYEGQP VIFYRDYEEW LNKDRLNNLI WIHDHLAGGS TSIVYYDSDE
AFILTYEGQP VIFYRDYEEW LNKDKLNNLI WIHDHLAGGS TSIVYYDSDE
AFILTYEGQP VIFYRDFEEW LNKDKLINLI WIHDHLAGGS TTIVYYDNDE
AFILTYEGQP VIFYRDYEEW LNKDRLKNLI WIHNNLAGGS TSIVYYDNDE
AFILTYEGQP AIFYRDYEEW LNKDRLRNLI WIHDHLAGGS TDIIYYDSDE
AFILTYEGQP -IFYRD -EEW LNKD-L-NLI WIH--LAGGS T-I-YYD-DE
```

SEQ ID NO 82
pyro (SEQ ID NO 313)
pyro2 (SEQ ID NO 314)
thermo (SEQ ID NO 315)
thermo2 (SEQ ID NO 316)
Consensus (SEQ ID NO 317)

```
401                                     450
MIFVRNGYGS KPGLITYINL GSSKVGRWVY VPKFAGACIH EYTGNLGGWV
LIFVRNGDSK RPGLITYINL GSSKVGRWVY VPKFAGACIH EYTGNLGGWV
LIFVRNGDSR RPGLITYINL SPNWWGRWVY VPKFAGACIH EYTGNLGGWV
LIFVRNGYGN KPGLITYINL GSSKVGRWVY VPKFAGSCIH EYTGNLGGWV
LIFVRNGYGD KPGLITYINL GSSKAGRWVY VPKFAGSCIH EYTGNLGGWI
-IFVRNG--- -PGLITYINL -----GRWVY VPKFAG-CIH EYTGNLGGW-
```

SEQ ID NO 82
pyro (SEQ ID NO 313)
pyro2 (SEQ ID NO 314)
thermo (SEQ ID NO 315)
thermo2 (SEQ ID NO 316)
Consensus (SEQ ID NO 317)

```
451                                     486
DKYVYSSGWV YFEAPAYDPA NGQYGYSVWS YCGVG*
DKYVESSGWV YLEAPAYDPA SGQYGYTVWS YCGVG*
DKRVDSSGWV YLEAPPHDPA NGYYGYSVWS YCGVG*
DKYVGSNGWV YLEAPAHDP A KGQYGYSVWS YCGVG*
DKWVDSSGRV YLEAPAHDP A NGQYGYSVWS YCGVG*
DK-V-S-G-V Y-EAP--DPA -G-YGY-VWS YCGVG*
Anti sense primer
```

Figure 14A-2



```

1
SEQ ID NO:82 -----MKK FVA LFITMFFV VS MAVVAQPASA
pyro (SEQ ID NO:313) -----MKK FVA LLITMFFV VS MAAVAQPASA
SEQ ID NO:74 -----
thermo2 (SEQ ID NO:316) -----MA RKVLVALL VF LVVLSVSAV P
SEQ ID NO:76 -----
SEQ ID NO:78 -----
SEQ ID NO:84 -----
SEQ ID NO:86 -----
SEQ ID NO:80 -----MKP AKL LVFVLVVS IL AGLYAQPAGA
thermo (SEQ ID NO:315) SESQC TATCT WRVVYM SAKK LLALLFV LAV LVGVAVIPAR VGIAPVSA GA
pyro2 (SEQ ID NO:314) -----VN IKK LTPLLTLL LF FIVLASPVSA
CLONE A (SEQ ID NO:318) -----MRRS ARV LVLIIAFFLL AGIYYPSTSA
Consensus (SEQ ID NO:319) -----

51
SEQ ID NO:82 AKYSE LEEGG VIMQAF YWDV PGGGIWWD TI RSKIPEWY EA GISAIWIPPA
pyro (SEQ ID NO:313) AKYSE LEEGG VIMQAF YWDV PAGGIWWD TI RSKIPEWY EA GISAIWIPPA
SEQ ID NO:74 ---MA LEEGG LIMQAF YWDV PGGGIWWD TI AQKIPDWA SA GISAIWIPPA
thermo2 (SEQ ID NO:316) AKAET LENGG VIMQAF YWDV PGGGIWWD TI AQKIPDWA SA GISAIWIPPA
SEQ ID NO:76 ---MA LEEGG LIMQAF YWDV PMGGIWWD TI AQKIPDWA SA GISAIWIPPA
SEQ ID NO:78 ---MA LEEGG LIMQAF YWDV PMGGIWWD TI AQKIPDWA SA GISAIWIPPA
SEQ ID NO:84 ---MA LEEGG LIMQAF YWDV PGGGIWWD TI AQKIPDWA SA GISAIWIPPA
SEQ ID NO:86 ---MA LEEGG LIMQAF YWDV PGGGIWWD TI AQKIPDWA SA GISAIWIPPA
SEQ ID NO:80 AKYLE LEEGG VIMQAF YWDV PSGGIWWD TI RQKIPEWY DA GISAIWIPPA
thermo (SEQ ID NO:315) TSRPS LEEGG VIMQAF YWDV PAGGIWWD TI RSKIPEWY EA GISAIWIPPA
pyro2 (SEQ ID NO:314) AKYLE LEEGG VIMQAF YWDV PGGGIWWD TI RSKIPEWY EA GISAIWIPPA
CLONE A (SEQ ID NO:318) AKYSE LEQGG VIMQAF YWDV PEGGIWWD TI RQKIPEWY DA GISAIWIPPA
Consensus (SEQ ID NO:319) -----GG -IMQAF YWDV P-GGIWWD-I --KIP-W--A GISAIW-PP-

101
SEQ ID NO:82 SKGMS GGYSM GYDPYD FFDL GEYNQKG TIE TRFGSKQE LI NMINTAHAY G
pyro (SEQ ID NO:313) SKGMG GAYSM GYDPYD FFDL GEYNQKG TVE TRFGSKQE LI NMINTAHAY G
SEQ ID NO:74 SKGMS GGYSM GYDPYD FFDL GEYYQKG SVE TRFGSKEE LV NMINTAHAY N
thermo2 (SEQ ID NO:316) SKGMS GGYSM GYDPYD FFDL GEYYQKG SVE TRFGSKEE LV NMINTAHAY N
SEQ ID NO:76 SKGMS GGYSM GYDPYD YFDL GEYYQKG TVE TRFGSKQE LI NMINTAHAY G
SEQ ID NO:78 SKGMS GGYSM GYDPYD YFDL GEYYQKG TVE TRFGSKQE LI NMINTAHAY G
SEQ ID NO:84 SKGMS GGYSM GYDPYD FFDL GEYYQKG TVE TRFGSKEE LV NMINTAHAY G
SEQ ID NO:86 SKGMS GGYSM GYDPYD FFDL GEYYQKG TVE TRFGSKEE LV NMINTAHAY G
SEQ ID NO:80 SKGMG GAYSM GYDPYD FFDL GEYDQKG TVE TRFGSKQE LV NMINTAHAY G
thermo (SEQ ID NO:315) SKGMS GAYSM GYDPYD FFDL GEYYQKG TVE TRFGSKQE LI NMINTAHAY G
pyro2 (SEQ ID NO:314) SKGMS GGYSM GYDPYD YFDL GEYYQKG TVE TRFGSKEE LV RLIQTAHAY G
CLONE A (SEQ ID NO:318) SKGMG GAYSM GYDPYD YFDL GEFYQKG TVE TRFGSKEE LV NMISTAHQY G
Consensus (SEQ ID NO:319) SKGM- G-YSM GYDPYD -FDL GE--QKG --E TRFGSK-E-L- --I-TAH--

151
SEQ ID NO:82 IKVIADIVIN HRAGGD LEWN PFVGDYT WTD FSKVASGK YT ANYLDFHPN E
pyro (SEQ ID NO:313) IKVIADIVIN HRAGGD LEWN PFVGDYT WTD FSKVASGK YT ANYLDFHPN E
SEQ ID NO:74 MKVIADIVIN HRAGGD LEWN PFTNSYT WTD FSKVASGK YT ANYLDFHPN E
thermo2 (SEQ ID NO:316) MKVIADIVIN HRAGGD LEWN PFTNSYT WTD FSKVASGK YT ANYLDFHPN E
SEQ ID NO:76 MKVIADIVIN HRAGGD LEWN PFVNDYT WTD FSKVASGK YT ANYLDFHPN E
SEQ ID NO:78 MKVIADIVIN HRAGGD LEWN PFVNDYT WTD FSKVASGK YT ANYLDFHPN E
SEQ ID NO:84 IKVIADIVIN HRAGGD LEWN PFVNDYT WTD FSKVASGK YT ANYLDFHPN E
SEQ ID NO:86 IKVIADIVIN HRAGGD LEWN PFVNDYT WTD FSKVASGK YT ANYLDFHPN E
SEQ ID NO:80 IKVIADIVIN HRAGGD LEWN PFVNDYT WTD FSKVASGK YT ANYLDFHPN E
thermo (SEQ ID NO:315) IKVIADIVIN HRAGGD LEWN PFTNSYT WTD FSKVASGK YT ANYLDFHPN E
pyro2 (SEQ ID NO:314) IKVIADIVIN HRAGGD LEWN PFVGDYT WTD FSKVASGK YT ANYLDFHPN E
CLONE A (SEQ ID NO:318) IKVIADIVIN HRAGGD LEWN PFVGDYT WTD FSKVASGK YT ANYLDFHPN E
Consensus (SEQ ID NO:319) -KVIAD-VIN HRAGG- LEWN P-----YT WTD FSKVASGK Y- A-Y-DFHPN -

50
100
150
200
```

Figure 14B-1



```

201
SEQ ID NO:82 VKCCDEGTFG GFPDIAHEKS WDQHWLWASD ESYAAYLR SI GVDAWRFDY V
pyro (SEQ ID NO:313) VKCCDEGTFG GFPDIAHEKE WDQHWLWASD ESYAAYLR SI GVDAWRFDY V
SEQ ID NO:74 LHAGD SGTFG GYPDIC HDKS WDQHWLWASN ESYAAYLR SI GIDAWRFDY V
thermo2 (SEQ ID NO:316) LHAGD SGTFG GYPDIC HDKS WDQHWLWASN ESYAAYLR SI GIDAWRFDY V
SEQ ID NO:76 LHAGD SGTFG GYPDIC HDKS WDQYWLWASQ ESYAAYLR SI GIDAWRFDY V
SEQ ID NO:78 LHAGD SGTFG GYPDIC HDKS WDQYWLWASQ ESYAAYLR SI GIDAWRFDY V
SEQ ID NO:84 LHCCDEGTFG GYPDIC HDKS WDQYWLWASS ESYAAYLR SI GVDAWRFDY V
SEQ ID NO:86 LHCCDEGTFG GYPDIC HDKS WDQYWLWASS ESYAAYLR SI GVDACWCFDY V
SEQ ID NO:80 VKCCDEGTFG GFPDIAHEKS WDQYWLWASN ESYAAYLR SI GVDAWRFDY V
thermo (SEQ ID NO:315) VKCCDEGTFG GFPDIAHEKS WDQYWLWASQ KSYAAYLR SI GIDAWRFDY V
pyro2 (SEQ ID NO:314) LHCCDEGTFG GFPDIC HHKE WDQYWLW KSN ESYAAYLR SI GFDGWRFDY V
CLONE A (SEQ ID NO:318) YSTSEGTFG GFPDIDHLVP FNQYWLWASN ESYAAYLR SI GIDAWRFDY V
Consensus (SEQ ID NO:319) ---D-GTFG G-PDI-H--- --Q-WLW-S- -SYAAYLR SI G-D-W-FDY V

251
SEQ ID NO:82 KGYGA WVVKD WLNWWG GWAV GEYWDTN VDA LLNWAYSS GA KVFDFFPLY K
pyro (SEQ ID NO:313) KGYGA WVVKD WLNWWG GWAV GEYWDTN VDA LLNWAYSS GA KVFDFFPLY K
SEQ ID NO:74 KGYAP WVVKN WLNRRG GWAV GEYWDTN VDA LLSWAYDS GA KVFDFFPLY K
thermo2 (SEQ ID NO:316) KGYAP WVVKN WLNRRG GWAV GEYWDTN VDA LLSWAYDS GA KVFDFFPLY K
SEQ ID NO:76 KGYAP WVVVD WLNWWG GWAV GEYWDTN VDA VLNWAYSS GA KVFDFFALY K
SEQ ID NO:78 KGYAP WVVVD WLNWWG GWAV GEYWDTN VDA VLNWAYSS GA KVFDFFALY K
SEQ ID NO:84 KGYGA WVVND WLSWWG GWAV GEYWDTN VDA LLNWAYSS GA KVFDFFPLY K
SEQ ID NO:86 KGYGA WVVND WLSWWG GWAV GEYWDTN VDA LLNWAYNS GA KVFDFFPLY K
SEQ ID NO:80 KGYGA WVVVD WLDWWG GWAV GEYWDTN VDA LLNWAYSS DA KVFDFFPLY K
thermo (SEQ ID NO:315) KGYGA WVVVD WLKWW . ALAV GEYWDTN VDA LLNWAYSS GA KVFDFFPLY K
pyro2 (SEQ ID NO:314) KGYAP WVVVD WLNWWG GWAV GEYWDTN VDA LLSWAYES GA KVFDFFPLY K
CLONE A (SEQ ID NO:318) KGYGA WVVVD WLSQWG GWAV GEYWDTN VDA LLNWAYSS GA KVFDFFPLY K
Consensus (SEQ ID NO:319) KGY--WVV-- WL--W-- --AV GEYWDTN VDA -L-WAY-S-A KVFDFF-LYY K

301
SEQ ID NO:82 MDEAF DNKNI PALVSA LQNG QTVVSRD PFK AVTFVANH DT DIIWNKYLA Y
pyro (SEQ ID NO:313) MDEAF DNTNI PALVDA LQNG GTVVSRD PFK AVTFVANH DT DIIWNKYPA Y
SEQ ID NO:74 MDEAF DNNNI PALVDA LKNG GTVVSRD PFK AVTFVANH DT NIIWNKYPA Y
thermo2 (SEQ ID NO:316) MDEAF DNNNI PALVDA LKNG GTVVSRD PFK AVTFVANH DT NIIWNKYPA Y
SEQ ID NO:76 MDEAF DNNNI PALVDA LRYG QTVVSRD PFK AVTFVANH DT DIIWNKYPA Y
SEQ ID NO:78 MDEAF DNNNI PALVDA LRYG QTVVSRD PFK AVTFVANH DT DIIWNKYPA Y
SEQ ID NO:84 MDEAF DNTNI PALVDA LRYG QTVVSRD PFK AVTFVANH DT DIIWNKYPA Y
SEQ ID NO:86 MDEAF DNTNI PALVYA LKNG GTVVSRD PFK AVTFVANH DT DIIWNKYPA Y
SEQ ID NO:80 MDAAF DNKNI PALVEA LKNG GTVVSRD PFK AVTFVANH DT DIIWNKYPA Y
thermo (SEQ ID NO:315) MDEAF DNKNI PALVSA LQNG QTVVSRD PFK AVTFVANH DT DIIWNKYPA Y
pyro2 (SEQ ID NO:314) MDEAF DNNNI PALVYA LQNG QTVVSRD PFK AVTFVANH DT DIIWNKYPA Y
CLONE A (SEQ ID NO:318) MDEAF DNKNI PALVYA IQNG ETVVSRD PFK AVTFVANH DT NIIWNKYPA Y
Consensus (SEQ ID NO:319) MD-AF DN-NI PALV-A ---G -TVVSRD PFK AVTFVANH DT -IWNKY-AY

351
SEQ ID NO:82 AFILTYEGQP VIFYRD YEEW LNKDRLN NLI WIHDHLAGGS TSIVYYDSDE
pyro (SEQ ID NO:313) AFILTYEGQP VIFYRD YEEW LNKDKLN NLI WIHDHLAGGS TSIVYYDSDE
SEQ ID NO:74 AFILTYEGQP AIFYRD YEEW LNKDRLR NLI WIHDHLAGGS TDIIYYDSDE
thermo2 (SEQ ID NO:316) AFILTYEGQP AIFYRD YEEW LNKDRLR NLI WIHDHLAGGS TDIIYYDSDE
SEQ ID NO:76 AFILTYEGQP TIFYRD YEEW LNKDKLN NLI WIHDNLAGGS TDIVYYDNDE
SEQ ID NO:78 AFILTYEGQP TIFYRD YEEW LNKDKLN NLI WIHDNLAGGS TDIVYYDNDE
SEQ ID NO:84 AFILTYEGQP VIFYRD YEEW LNKDKLN NLI WIHDHLAGGS TDIVYYDSDE
SEQ ID NO:86 AFILTYEGQP VIFYRD YEEW LNKDKLN NLI WIHDHLAGGS TDIVYYDSDE
SEQ ID NO:80 AFILTYEGQP TIFYRD YEEW LNKDRLN NLI WIHDHLAGGS TDIVYYDNDE
thermo (SEQ ID NO:315) AFILTYEGQP VIFYRD YEEW LNKDRLN NLI WIHNNLAGGS TSIVYYDNDE
pyro2 (SEQ ID NO:314) AFILTYEGQP VIFYRD FEEW LNKDKLI NLI WIHDHLAGGS TTIVYYDNDE
CLONE A (SEQ ID NO:318) AFILTYEGQP VIFYRD YEEW LNKDKLN NLI WIHEHLAGGS TKILYYDDDE
Consensus (SEQ ID NO:319) AFILTYEGQP -IFYRD -EEW LNKD-L- NLI WIH--LAGGS T-I-YYD-DE
```

Figure 14B-2



Appln No.: 10/081,872

Page 18 of 116

Applicant(s): Walter Callen et al.

ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

	401		450
SEQ ID NO:82	MIFVRNGYGS	KPGLITYINL	GSSKVGRWVY V.PKFAGACI HEYTGNLGGW
pyro (SEQ ID NO:313)	LIFVRNGDSK	RPGLITYINL	GSSKVGRWVY V.PKFAGACI HEYTGNLGGW
SEQ ID NO:74	LIFVRNGYGD	KPGLITYINL	GSSKAGR WVY V.PKFAGSCI HEYTGNLGGW
thermo2 (SEQ ID NO:316)	LIFVRNGYGD	KPGLITYINL	GSSKAGR WVY V.PKFAGSCI HEYTGNLGGW
SEQ ID NO:76	LIFVRNGYGS	KPGLITYINL	GSSKAGR WVY V.PKFAGSCI HEYTGNLGGW
SEQ ID NO:78	LIFVRNGYGS	KPGLITYINL	ASSKAGR WVY V.PKFAGSCI HEYTGNLGGW
SEQ ID NO:84	LIFVRNGYGT	KPGLITYINL	GSSKVGR WVY V.PKFAGSCI HEYTGNLGGW
SEQ ID NO:86	LIFVRNGYGT	KPGLITYINL	GSSKAGR WVY V.PKFAGSCI HEYTGSLGGW
SEQ ID NO:80	LIFVRNGYGD	KPGLITYINL	GSSKAGR WVY V.PKFAGACI HEYTGNLGGW
thermo (SEQ ID NO:315)	LIFVRNGYGN	KPGLITYINL	GSSKVGR WVY V.PKFAGSCI HEYTGNLGGW
pyro2 (SEQ ID NO:314)	LIFVRNGDSR	RPGLITYINL	SPNWVGR WVY V.PKFAGACI HEYTGNLGGW
CLONE A (SEQ ID NO:318)	LIFMR EGYGD	RPGLITYINL	GSDWAER WVN VGSKFAGY TI HEYTGNLGGW
Consensus (SEQ ID NO:319)	-IF-R -G---	-PGLITYINL	-----RWV- V--KFAG- -I HEYTG-LGGW
	451		487
SEQ ID NO:82	VDKYV YSSGW	VYFEAP AYDP	ANGQYGY SVW SYCGVG*
pyro (SEQ ID NO:313)	VDKYV ESSGW	VYLEAP AYDP	ASGQYGY TVW SYCGVG*
SEQ ID NO:74	IDKWV DSSGR	VYLEAP AHDP	ANGQYGY SVW SYCGVG*
thermo2 (SEQ ID NO:316)	IDKWV DSSGR	VYLEAP AHDP	ANGQYGY SVW SYCGVG*
SEQ ID NO:76	VDKWV DSSGW	VYLEAP AHDP	ANGQYGY SVW SYCGVG*
SEQ ID NO:78	VDKWV DSSGW	VYLEAP AHDP	ANGQYGY SVW SYCGVG*
SEQ ID NO:84	IDKYV SSSGW	VYLEAP AHDP	ANGYYGY SVW SYCGVG*
SEQ ID NO:86	IDKYV SSSGW	VYLEAP AHDP	ANGQYGY SVW SYCGVG*
SEQ ID NO:80	VDKWV DSSGW	VYLEAP AHDP	ANGYYGY SVW SYCGVG*
thermo (SEQ ID NO:315)	VDKYV GSNGW	VYLEAP AHDP	AKGQYGY SVW SYCGVG*
pyro2 (SEQ ID NO:314)	VDKRV DSSGW	VYLEAP PHDP	ANGYYGY SVW SYCGVG*
CLONE A (SEQ ID NO:318)	VDRYV QYDGW	VKLTAP PHDP	ANGYYGY SVW SYAGVG*
Consensus (SEQ ID NO:319)	-D--V ---G-	V---AP --DP	A-G-YGY -VW SY-GVG*

Figure 14B-3



	1				50
SEQ ID NO:83	-----	-----	-----	-----	-----
SEQ ID NO:85	-----	-----	-----	-----	-----
SEQ ID NO:75	-----	-----	-----	-----	-----
SEQ ID NO:77	-----	-----	-----	-----	-----
SEQ ID NO:73	-----	-----	-----	-----	-----
SEQ ID NO:79	----ATGA AGC	CTGCGAAA CT	CCTCGTCTT T	GTGCTCGTAG	TCTCTATCCT
SEQ ID NO:81	----ATGA AGA	AGTTTGTGTC GC	CCTGTTCAT A	ACCATGTTTT	TCGTAGTGAG
CLONE A (SEQ ID NO:320)	ATGAGGAG GAT	CCGCAAGG GT	TTTGGTTCT G	ATTATAGCGT	TTTTCTCTCT
Consensus (SEQ ID NO:321)	-----	-----	-----	-----	-----
	51				100
SEQ ID NO:83	-----	-----	-----	-----	ATGGCTCTGG
SEQ ID NO:85	-----	-----	-----	-----	ATGGCTCTGG
SEQ ID NO:75	-----	-----	-----	-----	ATGGCTCTGG
SEQ ID NO:77	-----	-----	-----	-----	ATGGCTCTGG
SEQ ID NO:73	-----	-----	-----	-----	ATGGCTCTGG
SEQ ID NO:79	CGCGGGG CTC	TACGCCCA GC	CCGCGGGGG C	GGCCAAGTAC	CTGGAGCTCG
SEQ ID NO:81	CATGGCA GTC	GTTGCACA GC	CAGCTAGCG C	CGCAAAGTAT	TCCGAGCTCG
CLONE A (SEQ ID NO:320)	GGCGGGG ATT	TACTACCC CT	CCACGAGTG C	CGCGAAGTAC	TCCGAGCTGG
Consensus (SEQ ID NO:321)	-----	-----	-----	-----	-----
	101				150
SEQ ID NO:83	AAGAGGG CGG	GCTCATAA TG	CAGGCCTTC T	ACTGGGATGT	TCCTGGAGGA
SEQ ID NO:85	AAGAGGG CGG	GCTTATAA TG	CAGGCATTC T	ATTGGGACGT	CCCAGGTGGA
SEQ ID NO:75	AAGAGGG CGG	GCTTATAA TG	CAGGCATTC T	ACTGGGACGT	CCCCATGGGA
SEQ ID NO:77	AAGAGGG CGG	GCTCATAA TG	CAGGCCTTC T	ACTGGGACGT	CCCCATGGGA
SEQ ID NO:73	TAGAGGG CGG	GCTTATAA TG	CAGGCCTTC T	ACTGGGACGT	CCCAGGTGGA
SEQ ID NO:79	AAGAGGG CGG	CGTCATAA TG	CAGGCGTTC T	ACTGGGACGT	GCCTTCAGGA
SEQ ID NO:81	AAGAAGG CGG	CGTTATAA TG	CAGGCCTTC T	ACTGGGACGT	CCCAGGTGGA
CLONE A (SEQ ID NO:320)	AGCAGGG CGG	AGTCATAA TG	CAGGCCTTC T	ACTGGGACGT	TCCGGAGGGA
Consensus (SEQ ID NO:321)	----GG CGG	--T-ATAA TG	CAGGC-TTC T	A-TGGGA-GT	-CC----GGA
	151				200
SEQ ID NO:83	GGAATCT GGT	GGGACACA AT	AGCTCAAAA G	ATACCCGAAT	GGGCAAGTGC
SEQ ID NO:85	GGAATCT GGT	GGGACACC AT	AGCCCAGAA G	ATACCCGAAT	GGGCAAGTGC
SEQ ID NO:75	GGAATCT GGT	GGGACACG AT	AGCCCAGAA G	ATACCCGACT	GGGCAAGCGC
SEQ ID NO:77	GGAATCT GGT	GGGACACG AT	AGCCCAGAA G	ATACCCGACT	GGGCAAGCGC
SEQ ID NO:73	GGAATCT GGT	GGGACACC AT	AGCCCAGAA G	ATACCCGACT	GGGCGAGCGC
SEQ ID NO:79	GGAATAT GGT	GGGACACA AT	ACGGCAGAA G	ATACCGGAGT	GGTACGATGC
SEQ ID NO:81	GGAATCT GGT	GGGACACC AT	CAGGAGCAA G	ATACCGGAGT	GGTACGAGGC
CLONE A (SEQ ID NO:320)	GGAATCT GGT	GGGACACA AT	ACGGCAGAA G	ATCCCTGAAT	GGTACGATGC
Consensus (SEQ ID NO:321)	GGAAT-T GGT	GGGACAC- AT	-----AA G	AT-CC-GA-T	GG-----GC
	201				250
SEQ ID NO:83	AGGAATC TCA	GCGATATG GA	TTCCACCAG C	GAGTAAGGGC	ATGAGCGGTG
SEQ ID NO:85	AGGAATC TCA	GCGATATG GA	TTCCACCAG C	GAGTAAGGGA	ATGAGCGGTG
SEQ ID NO:75	CGGGATT TCG	GCGATATG GA	TTCCCCCGG C	GAGCAAGGGT	ATGAGCGGCG
SEQ ID NO:77	CGGGATT TCG	GCGATATG GA	TCCCTCCCG C	GAGCAAGGGT	ATGAGCGGCG
SEQ ID NO:73	CGGGATT TCG	GCAATATG GA	TTCTTCCCG C	GAGTAAGGGC	ATGAGCGGCG
SEQ ID NO:79	CGGAATC TCC	GCAATATG GA	TTCCCCCGG C	GAGCAAGGGC	ATGGGCGGCG
SEQ ID NO:81	GGGAATA TCC	GCCATTTG GA	TTCCGCCAG C	CAGCAAGGGG	ATGAGCGGCG
CLONE A (SEQ ID NO:320)	AGGCATA TCC	GCCATCTG GA	TACCCCGG C	GAGCAAGGGC	ATGGGCGGGG
Consensus (SEQ ID NO:321)	-GG-AT- TC-	GC-AT-TG GA	T-CC-CC-G C	-AG-AAGGG-	ATG-GCGG-G

Figure 14C-1



Appln No.: 10/081,872

Page 20 of 116

Applicant(s): Walter Callen et al.

ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

```

251
SEQ ID NO:83 GTTATTC CAT GGGCTACG AT CCCTACGAT T TCTTTGACCT CGGCGAGTAC
SEQ ID NO:85 GTTATTC CAT GGGCTACG AT CCCTACGAT T TCTTTGACCT CGGCGAGTAC
SEQ ID NO:75 GCTATTC GAT GGGCTACG AC CCCTACGAT T ATTTTGACCT CGGTGAGTAC
SEQ ID NO:77 GCTATTC GAT GGGCTACG AC CCCTACGAT T ATTTTGACCT CGGTGAGTAC
SEQ ID NO:73 GCTATTC GAT GGGCTACG AC CCCTACGAT T TCTTCGACCT CGGTGAGTAC
SEQ ID NO:79 CCTATTC GAT GGGCTACG AC CCCTACGAT T TCTTTGACCT CGGTGAGTAC
SEQ ID NO:81 GTTACTC GAT GGGCTACG AT CCCTACGAT T TCTTTGACCT CGGCGAGTAC
CLONE A (SEQ ID NO:320) CCTACTC GAT GGGCTACG AC CCCTACGAT T ACTTCGATCT GGGCGAGTTT
Consensus (SEQ ID NO:321) --TA-TC -AT GGGCTACGA - CCCTACGA- T --TT-GA-CT -GG-GAGT--

301
SEQ ID NO:83 TATCAGA AGG GGACAGTT GA GACGCGCTT C GGCTCAAAGG AAGAAGCTGGT
SEQ ID NO:85 TATCAGA AGG GGACAGTT GA GACGCGCTT C GGCTCAAAGG AAGAAGCTGGT
SEQ ID NO:75 TACCAGA AGG GAACGGTG GA AACAAGATT C GGCTCAAAGC AGGAGCTCAT
SEQ ID NO:77 TACCAGA AGG GAACGGTG GA AACGAGGTT C GGCTCAAAGC AGGAGCTCAT
SEQ ID NO:73 TACCAGA AGG GAACGGTG GA GACCCGCTT C GGATCAAAAG AGGAGCTTGT
SEQ ID NO:79 GACCAGA AGG GAACGGTA GA GACGCGCTT T GGCTCCAAGC AGGAGCTCGT
SEQ ID NO:81 AACCAGA AGG GAACCATC GA AACGCGCTT T GGCTCTAAAC AGGAGCTCAT
CLONE A (SEQ ID NO:320) TACCAGA AGG GAACGGTT GA GACCCGCTT C GGCTCCAAGG AAGAGCTCGT
Consensus (SEQ ID NO:321) -A-CAGA AGG G-A-- -T-GA -AC--G-TT -GG-TC-AA-- A-GA-CT--T

351
SEQ ID NO:83 GAACATG ATA AACACCGC AC ACTCCTACG G CATAAAGGTG ATAGCAGACA
SEQ ID NO:85 GAACATG ATA AACACCGC AC ACTCCTACG G CATAAAGGTG ATAGCGGACA
SEQ ID NO:75 AAACATG ATA AACACCGC CC ACGCCTATG G CATGAAGGTA ATAGCCGATA
SEQ ID NO:77 AAACATG ATA AACACCGC CC ACGCCTATG G CATGAAGGTA ATAGCCGATA
SEQ ID NO:73 GAACATG ATA AACACCGC CC ATGCTCACA A CATGAAGGTC ATAGCGGACA
SEQ ID NO:79 GAACATG ATA AACACCGC CC ACGCCTACG G CATCAAGGTC ATCGCAGACA
SEQ ID NO:81 CAATATG ATA AACACGGC CC ATGCCTACG G CATAAAGGTC ATAGCGGACA
CLONE A (SEQ ID NO:320) CAACATG ATC TCCACGGC CC ACCAGTACG G CATCAAGGTT ATAGCGGACA
Consensus (SEQ ID NO:321) -AA-ATG AT- --CAC-GC -C A-----A-- -CAT-AAGGT- AT-GC-GA-A

401
SEQ ID NO:83 TAGTCAT AAA CCACCGCG CC GGTGGAGAC C TTGAGTGGAA CCCCTTCGTG
SEQ ID NO:85 TAGTCAT AAA CCACCGCG CC GGTGGAGGC C TCGAGTGGAA CCCCTTCGTG
SEQ ID NO:75 TAGTCAT CAA CCACCGCG CC GGCGGCGAT C TGGAGTGGAA CCCCTTCGTG
SEQ ID NO:77 TAGTCAT CAA CCACCGCG CC GGCGGTGAC C TGGAGTGGAA CCCCTTCGTG
SEQ ID NO:73 TAGTCAT CAA CCACCGCG CC GGCGGCGAC C TGGAGTGGAA TCCTTTCACC
SEQ ID NO:79 TAGTAAT CAA CCACCGCG CC GGAGGAGAC C TTGAGTGGAA CCCCTTCGTC
SEQ ID NO:81 TCGTCAT AAA CCACCGCG CA GGCGGAGAC C TCGAGTGGAA CCCGTTTCGTT
CLONE A (SEQ ID NO:320) TAGTGAT AAA CCACCGCG CA GGTGGAGAC C TCGAATGGAA CCCATACGTC
Consensus (SEQ ID NO:321) T-GT-AT -AA CCACCGCG C- GG-GG-G-- C T-GA-TGGAA -CC-T-C---

451
SEQ ID NO:83 AACGACT ATA CCTGGACA GA CTTCTCAAA A GTCGCCTCCG GTAAATATAC
SEQ ID NO:85 AACGACT ATA CCTGGACA GA CTTCTCAAA A GTCGCCTCCG GTAAATATAC
SEQ ID NO:75 AACGACT ATA CCTGGACC GA CTTCTCGAA G GTCGCGTCGG GTAAATACAC
SEQ ID NO:77 AACGACT ATA CCTGGACC GA CTTCTCAAA G GTCGCGTCGG GTAAATACAC
SEQ ID NO:73 AACAGCT ACA CCTGGACC GA TTTCTCGAA G GTCGCGTCGG GCAAGTACAC
SEQ ID NO:79 AATGACT ACA CCTGGACG GA CTTCTCGAA G GTCGCTTCCG GCAAGTACAC
SEQ ID NO:81 GGGGACT ACA CCTGGACG GA CTTCTCAAA G GTGGCCTCGG GCAAATATAC
CLONE A (SEQ ID NO:320) GGCGACT ATA CCTGGACG GA CTTTCTAA G GTCGCCTCCG GGAAATACAA
Consensus (SEQ ID NO:321) -----CT A-A CCTGGAC- GA -TT-TC-AA -GT-GC-TC-G G-AA-TA-A-
```

Figure 14C-2

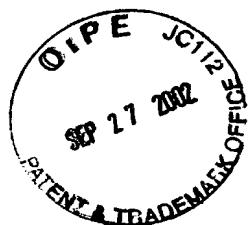


Appln No.: 10/081,872
Applicant(s): Walter Callen et al.
ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

Page 21 of 116

	501				550
SEQ ID NO:83	GGCCAAC TAC	CTTGACTT CC	ACCCAAACG A	GCTTCACTGT	TGTGATGAAG
SEQ ID NO:85	AGCCAAC TAC	CTTGACTT CC	ACCCAAACG A	GCTTCACTGT	TGTGATGAAG
SEQ ID NO:75	GGCCAAC TAC	CTCGACTT CC	ACCCGAACG A	GCTCCACGCG	GGCGATTCCG
SEQ ID NO:77	GGCCAAC TAC	CTCGACTT CC	ACCCGAACG A	GCTCCATGCG	GGCGATTCCG
SEQ ID NO:73	GGCCAAC TAC	CTCGACTT CC	ACCCGAACG A	GCTTCACGCG	GGCGATTCCG
SEQ ID NO:79	GGCCAAC TAC	CTCGACTT CC	ACCCCAACG A	GGTCAAGTGC	TGCGACGAGG
SEQ ID NO:81	TGCCAAC TAC	CTCGACTT CC	ACCCCAACG A	GGTCAAGTGC	TGTGACGAGG
CLONE A (SEQ ID NO:320)	GGCCAC TAC	ATGGACTT CC	ATCCAAACA A	CTACAGCACC	TCAGACGAGG
Consensus (SEQ ID NO:321)	-GCC-AC TAC	-T-GACTT CC	A-CC-AAC- A	-----	---GA----
	551				600
SEQ ID NO:83	GTACCTT TGG	AGGATACC CT	GATATATGT C	ACGACAAAAG	CTGGGACCAG
SEQ ID NO:85	GTACCTT TGG	AGGATACC CT	GATATATGT C	ACGACAAAAG	CTGGGACCAG
SEQ ID NO:75	GAACATT TGG	AGGCTATC CC	GACATATGC C	ACGACAAGAG	CTGGGACCAG
SEQ ID NO:77	GAACATT TGG	AGGCTATC CC	GACATATGC C	ACGACAAGAG	CTGGGACCAG
SEQ ID NO:73	GAACATT TGG	AGGCTATC CC	GACATATGC C	ACGACAAGAG	CTGGGACCAG
SEQ ID NO:79	GCACCTT TGG	AGGCTTCC CG	GACATAGCC C	ACGAGAAGAG	CTGGGACCAG
SEQ ID NO:81	GCACATT TGG	AGGCTTCC CA	GACATAGCC C	ACGAGAAGAG	CTGGGACCAG
CLONE A (SEQ ID NO:320)	GAACCTT CGG	TGGCTTCC CA	GACATTGAT C	ACCTCGTGCC	CTTCAACCAG
Consensus (SEQ ID NO:321)	G-AC-TT -GG	-GG-T--C -	GA-AT---- C	AC-----	CT---ACCAG
	601				650
SEQ ID NO:83	TACTGGC TCT	GGGCGAGC AG	CGAAAGCTA C	GCTGCCTACC	TCAGGAGCAT
SEQ ID NO:85	TACTGGC TCT	GGGCGAGC AG	CGAAAGCTA C	GCTGCCTACC	TCAGGAGCAT
SEQ ID NO:75	TACTGGC TCT	GGGCCAGC CA	GGAGAGCTA C	GCGGCCTATC	TCAGGAGCAT
SEQ ID NO:77	TACTGGC TCT	GGGCCAGC CA	GGAGAGCTA C	GCGGCATATC	TCAGGAGCAT
SEQ ID NO:73	CACTGGC TCT	GGGCCAGC AA	CGAAAGCTA C	GCCGCCTACC	TCCGGAGCAT
SEQ ID NO:79	TACTGGC TCT	GGGCGAGC AA	CGAGAGCTA C	GCCGCCTACC	TCAGGAGCAT
SEQ ID NO:81	CACTGGC TCT	GGGCGAGC GA	TGAGAGCTA C	GCCGCCTACC	TAAGGAGCAT
CLONE A (SEQ ID NO:320)	TACTGGC TGT	GGGCGAGC AA	CGAGAGCTA C	GCCGCCTACC	TCAGGAGCAT
Consensus (SEQ ID NO:321)	-ACTGGC T-T	GGGC-AGC --	-GA-AGCTA C	GC-GC-TA -C	T--GGAGCAT
	651				700
SEQ ID NO:83	AGGGGTT GAC	GCCTGGCG TT	TCGACTACG T	CAAGGGCTAC	GGAGCATGGG
SEQ ID NO:85	AGGGGTT GAC	GCCTGGTG TT	TCGACTACG T	CAAGGGCTAC	GGAGCCTGGG
SEQ ID NO:75	CGGCATC GAC	GCCTGGCG CT	TCGACTACG T	CAAGGGCTAT	GCTCCCTGGG
SEQ ID NO:77	CGGCATC GAT	GCCTGGCG CT	TCGACTACG T	CAAGGGCTAT	GCTCCCTGGG
SEQ ID NO:73	CGGCATC GAC	GCCTGGCG CT	TCGACTACG T	CAAGGGCTAC	GCTCCCTGGG
SEQ ID NO:79	CGGCGTT GAC	GCATGGCG CT	TCGACTACG T	CAAGGGCTAC	GGAGCCTGGG
SEQ ID NO:81	CGGCGTT GAT	GCCTGGCG CT	TTGACTACG T	GAAGGGCTAC	GGAGCCTGGG
CLONE A (SEQ ID NO:320)	AGGGATC GAT	GCGTGGCG CT	TTGACTACG T	TAAGGGCTAC	GGGCGTGGG
Consensus (SEQ ID NO:321)	-GG--T- GA-	GC-TGG-G -T	T-GACTACG T	-AAGGGCTA-	G---C-TGGG
	701				750
SEQ ID NO:83	TTGTTAA CGA	CTGGCTCAG C	TGGTGGGGA G	GCTGGGCCGT	TGGAGAGTAC
SEQ ID NO:85	TTGTTAA CGA	CTGGCTCAG C	TGGTGGGGA G	GCTGGGCCGT	TGGAGAGTAC
SEQ ID NO:75	TCGTCAA GGA	CTGGCTGA AC	TGGTGGGGA G	GCTGGGCAGT	TGGAGAGTAC
SEQ ID NO:77	TCGTCAA GGA	CTGGCTGA AC	TGGTGGGGA G	GCTGGGCCGT	TGGAGAGTAC
SEQ ID NO:73	TCGTCAA GAA	CTGGCTGA AC	CGGTGGGGC G	GCTGGGCCGT	TGGAGAGTAC
SEQ ID NO:79	TCGTCAA GGA	CTGGCTGG AC	TGGTGGGGA G	GCTGGGCCGT	CGGGAGTAC
SEQ ID NO:81	TCGTCAA GGA	CTGGCTCA AC	TGGTGGGGC G	GCTGGGCCGT	TGGCAGTAC
CLONE A (SEQ ID NO:320)	TCGTCAA GGA	CTGGCTGA GT	CAGTGGGGC G	GCTGGGCCGT	CGGCCAGTAC
Consensus (SEQ ID NO:321)	T-GT-A- -A	CTGGCT-- --	--GTGGGG- G	GCTGGGC-GT	-GG-GAGTAC

Figure 14C-3



751 800

SEQ ID NO:83	TGGGACA CGA	ACGTTGAT GC	ACTCCTCAA C	TGGGCATACA	GCAGCGGCGC
SEQ ID NO:85	TGGGACA CTA	ACGTTGAT GC	ACTCCTCAA C	TGGGCATACA	ACAGCGGCGC
SEQ ID NO:75	TGGGACA CCA	ACGTCGAC GC	TGTTCTCAA C	TGGGCATACT	CGAGCGGTGC
SEQ ID NO:77	TGGGACA CCA	ACGTCGAC GC	TGTTCTCAA C	TGGGCATACT	CGAGCGGTGC
SEQ ID NO:73	TGGGACA CCA	ACGTCGAT GC	ACTCCTGAG C	TGGGCCTACG	ACAGCGGTGC
SEQ ID NO:79	TGGGACA CAA	ACGTTGAT GC	ACTGCTCAA C	TGGGCCTACT	CGAGCGATGC
SEQ ID NO:81	TGGGACA CCA	ACGTTGAT GC	ACTCCTCAA C	TGGGCCTACT	CGAGCGGCGC
CLONE A (SEQ ID NO:320)	TGGGACA CCA	ACGTCGAT GC	GCTCCTCAA C	TGGGCCTACA	GCAGCGGCGC
Consensus (SEQ ID NO:321)	TGGGACA C-A	ACGT-GA- GC	--T-CT-A- C	TGGGC-TAC-	--AGCG--GC

801 850

SEQ ID NO:83	CAAGGTC TTT	GACTTCCC GC	TCTACTACA A	GATGGACGAA	GCCTTCGACA
SEQ ID NO:85	CAAGGTC TTT	GACTTCCC GC	TCTACTACA A	GATGGACGAA	GCCTTCGACA
SEQ ID NO:75	CAAGGTC TTT	GACTTCGC CC	TCTACTACA A	GATGGACGAG	GCCTTCGATA
SEQ ID NO:77	CAAGGTC TTT	GACTTCGC CC	TCTACTACA A	GATGGACGAG	GCCTTCGATA
SEQ ID NO:73	TAAAGTC TTC	GACTTCCC GC	TCTACTACA A	GATGGACGAG	GCCTTCGATA
SEQ ID NO:79	AAAAGTC TTC	GACTTCCC GC	TCTACTACA A	GATGGACGCG	GCCTTTGACA
SEQ ID NO:81	CAAGGTC TTC	GACTTCCC GC	TCTACTACA A	GATGGATGAG	GCCTTTGACA
CLONE A (SEQ ID NO:320)	CAAGGTC TTC	GACTTCCC GC	TCTACTACA A	GATGGACGAG	GCCTTTGACA
Consensus (SEQ ID NO:321)	-AA-GTC TT-	GACTTC-C -C	TCTACTACA A	GATGGA-G -	GCCTT-GA-A

851 900

SEQ ID NO:83	ACACCAA CAT	CCCCGCAT TA	GTGGATGCA C	TCAGATACGG	CCAGACAGTG
SEQ ID NO:85	ATACCAA CAT	CCCCGCTT TG	GTTTACGCC C	TCAAGAATGG	CGGGACAGTG
SEQ ID NO:75	ACAACAA CAT	TCCCGCCC TG	GTGGACGCC C	TCAGATACGG	CCAGACAGTG
SEQ ID NO:77	ACAACAA CAT	TCCCGCCC TG	GTGGACGCC C	TCAGATACGG	TCAGACAGTG
SEQ ID NO:73	ACAACAA CAT	CCCCGCCC TC	GTGGACGCC C	TCAAGAACGG	AGGCACGGTC
SEQ ID NO:79	ACAAGAA CAT	TCCCGCAC TC	GTCGAGGCC C	TCAAGAACGG	GGGCACAGTC
SEQ ID NO:81	ACAAAAA CAT	TCCAGCGC TC	GTCTCTGCC C	TTCAGAACGG	CCAGACTGTT
CLONE A (SEQ ID NO:320)	ACAAGAA CAT	TCCCGCCC TC	GTTTACGCC A	TCCAGAACGG	TGAAACCGTC
Consensus (SEQ ID NO:321)	A-A--AA CAT	-CC-GC-- T-	GT----GC- -	T-----A-GG	----AC-GT-

901 950

SEQ ID NO:83	GTCAGCC GCG	ATCCCTTC AA	GGCGGTAAC T	TTCGTTGCCA	ACCACGATAC
SEQ ID NO:85	GTCAGCC GCG	ACCCATTC AA	GGCGGTAAC T	TTCGTTGCCA	ACCACGATAC
SEQ ID NO:75	GTCAGCC GCG	ACCCGTTT AA	GGCTGTGAC G	TTTGTAGCCA	ACCACGATAC
SEQ ID NO:77	GTCAGCC GCG	ACCCGTTT AA	GGCTGTGAC G	TTTGTAGCCA	ACCACGATAC
SEQ ID NO:73	GTCAGCC GCG	ACCCGTTT AA	AGCCGTGAC C	TTCGTTGCCA	ACCACGATAC
SEQ ID NO:79	GTCAGCC GCG	ACCCGTTT AA	GGCCGTAAC C	TTCGTTGCAA	ACCACGACAC
SEQ ID NO:81	GTCTCCC GCG	ACCCGTTT AA	GGCCGTAAC C	TTTGTAGCAA	ACCACGACAC
CLONE A (SEQ ID NO:320)	GTCAGCA GGG	ATCCCTTC AA	GGCCGTTAC C	TTCGTGGCTA	ACCACGATAC
Consensus (SEQ ID NO:321)	GTC--C- G-G	A-CC-TT- AA	-GC-GT-AC -	TT-GT-GC-A	ACCACGA-AC

951 1000

SEQ ID NO:83	AGATATA ATC	TGGAACAA GT	ATCCGGCTT A	TGCATTTCATC	CTTACCTATG
SEQ ID NO:85	AGATATA ATC	TGGAACAA GT	ATCCGGCTT A	TGCATTTCATC	CTTACCTATG
SEQ ID NO:75	CGACATA ATC	TGGAACAA GT	ATCCAGCCT A	CGCGTTTCATC	CTCACCTACG
SEQ ID NO:77	CGACATA ATC	TGGAACAA GT	ATCCAGCCT A	CGCGTTTCATC	CTCACCTACG
SEQ ID NO:73	CAACATA ATC	TGGAACAA GT	ATCCGGCCT A	CGCCTTCATC	CTCACCTATG
SEQ ID NO:79	GGACATA ATT	TGGAACAA GT	ACCCGGCCT A	CGCCTTCATC	CTCACCTACG
SEQ ID NO:81	CGATATA ATC	TGGAACAA GT	ACCTTGCTT A	TGCTTTCATC	CTCACCTACG
CLONE A (SEQ ID NO:320)	GAACATA ATC	TGGAACAA GT	ACCCTGCCT A	TGCCTTCATC	CTGACCTACG
Consensus (SEQ ID NO:321)	--A-ATAAT-	TGGAACAA GT	A-C--GC-TA	-GC-TTCATC	CT-ACCTA-G

Figure 14C-4



```

1001
SEQ ID NO:83 AGGGACA GCC TGTTATAT TC TACCGCGAC T ACGAGGAGTG GCTCAACAAG
SEQ ID NO:85 AGGGACA GCC TGTTATAT TC TACCGCGAC T ACGAGGAGTG GCTCAACAAG
SEQ ID NO:75 AGGGCCA GCC GACAATAT TC TACCGCGAC T ACGAGGAGTG GCTCAACAAG
SEQ ID NO:77 AGGGCCA GCC GACAATAT TC TACCGCGAC T ACGAGGAGTG GCTCAACAAG
SEQ ID NO:73 AGGGACA GCC GGCAATAT TC TACCGCGAC T ACGAGGAGTG GCTCAACAAG
SEQ ID NO:79 AGGGCCA GCC GACGATAT TC TACCGCGAC T ACGAGGAGTG GCTCAACAAG
SEQ ID NO:81 AAGGCCA GCC CGTCATAT TT TACCGCGAC T ACGAGGAGTG GCTCAACAAG
CLONE A (SEQ ID NO:320) AAGGTCA GCC CGTCATCT TC TACCGCGAC T ACGAGGAGTG GCTCAACAAG
Consensus (SEQ ID NO:321) A-GG-CA-GCC ----AT-TT- TACCGCGAC T ACGAGGAGTG GCTCAACAAG

1051
SEQ ID NO:83 GATAAGC TTA ACAACCTC AT CTGGATACA C GATCACCTTG CTGGAGGGAG
SEQ ID NO:85 GATAAGC TTA ACAACCTC AT CTGGATACA C GATCACCTTG CTGGAGGGAG
SEQ ID NO:75 GACAAGC TCA AGAACCTC AT CTGGATACA T GACAACCTCG CCGAGGGGAG
SEQ ID NO:77 GATAAGC TCA AGAACCTC AT CTGGATACA T GACAACCTCG CCGAGGGGAG
SEQ ID NO:73 GACAGGC TCA GGAACCTC AT CTGGATACA C GACCACCTCG CCGGAGGAAG
SEQ ID NO:79 GACAGGC TCA AGAACCTC AT CTGGATACA C GACCACCTCG CCGGAGGAAG
SEQ ID NO:81 GACAGGT TGA ACAACCTC AT ATGGATACA C GACCACCTCG CAGGTGGAAG
CLONE A (SEQ ID NO:320) GACAAAC TCA ACAACCTC AT ATGGATTCA C GAGCACCTGG CAGGGGGAAG
Consensus (SEQ ID NO:321) GA-A---T-A --AACCTC AT -TGGAT-CA- GA--ACCT-G C-GG-GG-AG

1101
SEQ ID NO:83 TACTGAC ATT GTTTACTA CG ACAGCGACG A GCTTATCTTT GTGAGAAACG
SEQ ID NO:85 TACTGAC ATT GTTTACTA CG ACAGCGACG A GCTTATCTTT GTGAGAAACG
SEQ ID NO:75 CACTGAC ATC GTTTACTA CG ACAACGACG A GCTGATATTC GTGAGAAACG
SEQ ID NO:77 CACTGAC ATC GTTTACTA CG ACAACGACG A GCTGATATTC GTGAGAAACG
SEQ ID NO:73 CACAGAC ATC ATCTACTA CG ACAGCGACG A GCTTATCTTC GTGAGAAACG
SEQ ID NO:79 CACCGAC ATA GTCTACTA CG ATAACGATG A ACTCATCTTC GTCAGGAACG
SEQ ID NO:81 CACGAGC ATA GTTTACTA CG ACAGCGACG A GATGATTTTC GTGAGGAACG
CLONE A (SEQ ID NO:320) CACCAAG ATC CTCTACTA CG ACGACGATG A GCTCATCTTC ATGAGGGAAG
Consensus (SEQ ID NO:321) -AC-----AT- -T-TACTA CG A---CGA-GA --T-AT-TT- -T-AG--A-G

1151
SEQ ID NO:83 GCTATGG CAC CAAACCAG GA CTGATAACC T ATATCAACCT CGGCTCAAGC
SEQ ID NO:85 GCTATGG CAC CAAACCAG GA CTGATAACC T ATATCAACCT CGGCTCAAGC
SEQ ID NO:75 GCTACGG AAG CAAGCCGG GA CTGATAACA T ACATCAACCT CGGCTCAAGC
SEQ ID NO:77 GCTACGG AAG CAAGCCGG GA CTGATAACA T ACATCAACCT CGGCTCAAGC
SEQ ID NO:73 GCTACGG GGA CAAGCCGG GA CTGATAACC T ACATCAACCT CGGCTCAAGC
SEQ ID NO:79 GCTACGG GGA CAAGCCGG GG CTTATAACC T ACATCAACCT AGGCTCGAGC
SEQ ID NO:81 GCTATGG AAG CAAGCCTG GC CTTATAACT T ACATCAACCT CGGCTCGAGC
CLONE A (SEQ ID NO:320) GCTACGG CGA CAGGCCGG GG CTTATAACC T ACATCAACCT CGGTAGCGAC
Consensus (SEQ ID NO:321) GCTA-GG --- CA--CC-GG- CT-ATAAC- T A-ATCAACCT -G-----C

1201
SEQ ID NO:83 AAAGTTG GAA GGTGGGTC TA CGTT...CCA AAGTTCGCCG GTTCATGCAT
SEQ ID NO:85 AAAGCTG GAA GGTGGGTC TA CGTT...CCA AAGTTCGCCG GTTCATGCAT
SEQ ID NO:75 AAAGCCG GAA GGTGGGTT TA CGTT...CCG AAGTTCGCAG GCTCGTGCAT
SEQ ID NO:77 AAAGCCG GAA GGTGGGTT TA CGTT...CCG AAGTTCGCAG GCTCGTGCAT
SEQ ID NO:73 AAGGCCG GAA GGTGGGTC TA CGTT...CCG AAGTTCGCAG GCTCGTGCAT
SEQ ID NO:79 AAGGCCG GGA GGTGGGTC TA CGTT...CCG AAGTTCGCCG GAGCGTGCAT
SEQ ID NO:81 AAGGTTG GAA GGTGGGTT TA TGTG...CCG AAGTTCGCCG GCGCGTGCAT
CLONE A (SEQ ID NO:320) TGGGCCG AGA GATGGGTG AA CGTTGGCTC A AAGTTCGCCG GCTATACAAT
Consensus (SEQ ID NO:321) ---G--G--A G-TGGGT--A -GT-----C AAGTTCGC-G G-----AT
```

Figure 14C-5



Appin No.: 10/081,872

Page 24 of 116

Applicant(s): Walter Callen et al.

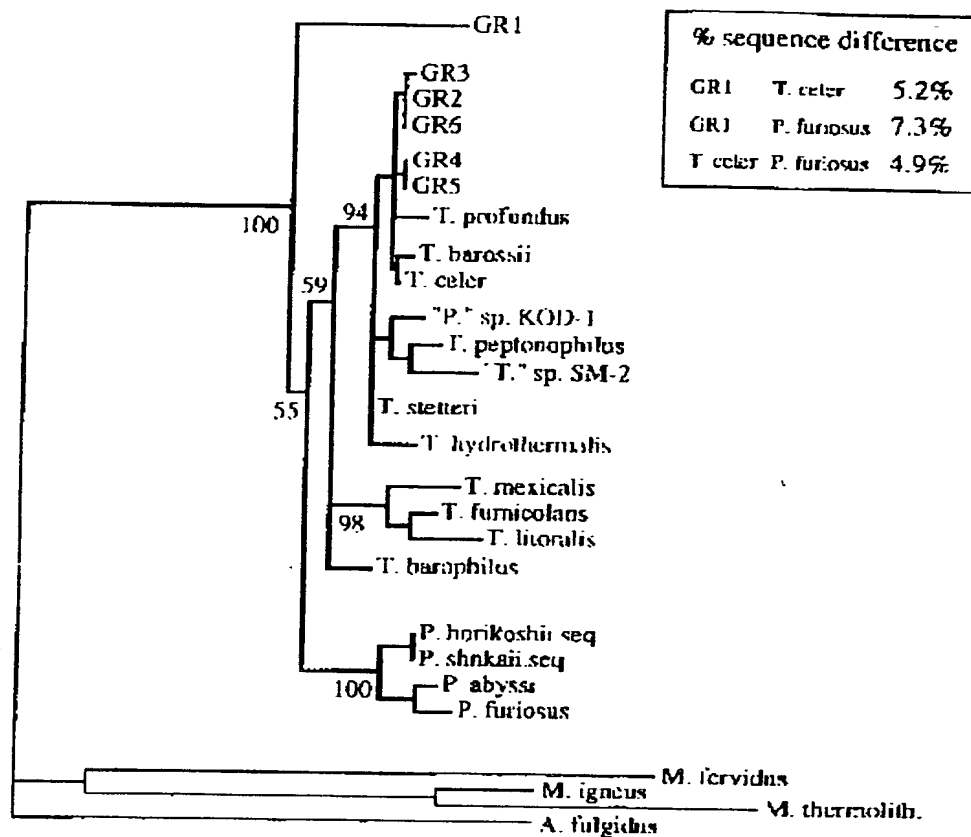
ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

	1251				1300
SEQ ID NO:83	CCACGAGTAC	ACCGGCAA CC	TCGGCGGTT G	GATAGACAAG	TACGTCTCCT
SEQ ID NO:85	CCACGAGTAC	ACCGGCAAG CC	TCGGCGGTT G	GATAGACAAG	TACGTCTCCT
SEQ ID NO:75	ACACGAGTAC	ACCGGCAA CC	TCGGCGGCT G	GGTGGACAAG	TGGGTGGACT
SEQ ID NO:77	ACACGAGTAC	ACCGGCAA TC	TCGGCGGCT G	GGTGGACAAG	TGGGTGGACT
SEQ ID NO:73	ACACGAGTAC	ACCGGCAA CC	TCGGCGGCT G	GATTGACAAG	TGGGTGGACT
SEQ ID NO:79	CCACGAGTAC	ACCGGCAA CC	TCGGCGGCT G	GGTGGACAAG	TGGGTGGACT
SEQ ID NO:81	CCACGAGTAT	ACTGGTAA CC	TCGGAGGCT G	GGTAGACAAG	TACGTCTACT
CLONE A (SEQ ID NO:320)	CCACGAA TAC	ACCGGAAA CC	TCGGCGGCT G	GGTCGACAGG	TACGTCCAGT
Consensus (SEQ ID NO:321)	-CACGA- TA-	AC-GG-A- -C	TCGG-GG-T G	G-T-GACA-G	T--GT----T
	1301				1350
SEQ ID NO:83	CCAGCGG CTG	GGTCTATC TT	GAGGCCCCAG	CCCACGACCC	GGCGAACGGC
SEQ ID NO:85	CCAGCGG CTG	GGTCTACC TT	GAGGCCCCG G	CCCACGACCC	GGCCAATGGC
SEQ ID NO:75	CAAGCGG CTG	GGTTTACC TC	GAGGCTCCT G	CCCACGACCC	GGCCAACGGC
SEQ ID NO:77	CAAGCGG CTG	GGTCTACC TC	GAGGCTCCT G	CCCACGACCC	GGCCAACGGC
SEQ ID NO:73	CAAGCGG TCG	GGTCTACC TT	GAGGCCCCG G	CCCACGACCC	GGCCAACGGC
SEQ ID NO:79	CAAGCGG GTG	GGTGTACC TC	GAGGCCCCCT G	CCCACGACCC	GGCCAACGGC
SEQ ID NO:81	CAAGCGG CTG	GGTCTATT TC	GAAGCTCCA G	CTTACGACCC	TGCCAACGGG
CLONE A (SEQ ID NO:320)	ACGACGG CTG	GGTCAAGC TT	ACCGCTCCG C	CACACGATCC	GGCAAACGGC
Consensus (SEQ ID NO:321)	----CGG --G	GGT--A-- T-	---GC-CC- -	C--ACGA-CC	-GC-AA-GG-
	1351				1393
SEQ ID NO:83	TACTACG GCT	ACTCCGTA TG	GAGCTACTG C	GGGGTTGGGT	GA~
SEQ ID NO:85	CAGTATG GCT	ACTCCGTC TG	GAGCTATTG C	GGGGTTGGGT	GA~
SEQ ID NO:75	CAGTACG GCT	ACTCCGTT TG	GAGCTATTG C	GGTGTGTTGGGT	GA~
SEQ ID NO:77	CAGTACG GCT	ACTCCGTC TG	GAGCTACTG C	GGTGTGTTGGGT	GA~
SEQ ID NO:73	CAGTACG GCT	ACTCCGTA TG	GAGCTACTG C	GGTGTGTTGGGT	GA~
SEQ ID NO:79	TATTACG GCT	ACTCCGTC TG	GAGCTACTG C	GGGGTGGGCT	GA~
SEQ ID NO:81	CAGTATG GCT	ACTCCGTG TG	GAGCTATTG C	GGTGTGTTGGGT	GA~
CLONE A (SEQ ID NO:320)	TATTACG GCT	ACTCCGTC TG	GAGCTACGC C	GGAGTTGGAT	GA~
Consensus (SEQ ID NO:321)	-A-TA-G GCT	ACTC-GT- TG	GAGCTA--- C	GG-GT-GG-T	GA~

Figure 14C-6



Neighbor-joining tree for Thermococcales



0.01
 bootstrap values for 100 replicates

Summit & Barnet, Deep-Sea Research Pt. II, in press

Figure 15



SEQ ID NO.: 1

atggcaaagtattccgagctcgaagagggcgggctcataatgcaggccttctactgggacgtcccatgggaggaatctggtgggacacgat
agcccagaagatacccgactgggcaagcgccgggatttcggcgatatggattccccggcgagcaagggcatgggcggcgccatttcgatg
ggctacgacccctacgacttcttgacctcggtagtacgaccagaagggaaacggtagagacgcgctttggctccaagcaggagctcgtgaa
catgataaacaccgcccacgctatggcatgaaggtaatagccgatatagtcatcaaccaccgcgccggcggtgacctggagtggaacccctt
cgtgaacgactatacctggaccgacttctcaaaggtcgcgtcgggtaaatacacggccaactacctcgacttccaccgaacgagctccatgc
ggcgatttcggaacatttggaggctatcccagacatatgccacgacaagagctgggaccagtactggctctgggccagccaggagagctac
gcggcatatctcaggagcatcggcatcgatgcctggcgcttcgactacgtcaagggtactcggagcgtgggtcgtcaaggactggctggactg
gtggggaggctgggcccgtcggggagtactgggacacaaacgttgatgcactgtcaactgggctactcagcgatgcaaaagtcttcgactt
cccgctctactacaagatggacgcggcctttgacaacaagaacattcccgcactcgtcaggccctcaagaacgggggcacagctcgcagcc
gcgacccgtttaaggccgtaaccttcgttgcaaacacgacaccgatataatctggaacaagatccagcctacgcgttcacctcacctacgag
ggccagccgacaatattctaccgcgactacgaggagtggctcaacaaggataagctcaagaacctcatctggatacatgacaacctcggcg
aggaagcactgacatcgtttactacgacaacgacgagctgatattcgtgagaacggctacggaagcaagccgggactgataacatacatcaa
cctcgctcaagcaaacgggaaggtgggtttacgttcgaaggtcgcaggctcgtgcatacacgagtacaccggcaatctcggcggtgggt
ggacaagtgggtgactcaagcggtgggtctacctcagggtcctgccacgacccggccaacggccagtacggctactcgtctggagc
tactcggtgttgggtga

SEQ ID NO.: 2

Met Ala Lys Tyr Ser Glu Leu Glu Gly Gly Leu Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Met
Gly Gly Ile Trp Trp Asp Thr Ile Ala Gln Lys Ile Pro Asp Trp Ala Ser Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Met Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly
Tyr Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala
Ala Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp Val
Val Lys Asp Trp Leu Asp Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala
Leu Leu Asn Trp Ala Tyr Ser Ser Asp Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Ala
Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Glu Ala Leu Lys Asn Gly Gly Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn
Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Ser Thr Asp Ile Val Tyr
Tyr Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Ala Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala His Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 3

atggccaagtacctggagctcgaagagggcgggctcataatgcaggccttctactgggacgtcccatgggaggaatctggtgggacacgat
agcccagaagatacccgactgggcaagcgccgggatttcggcgatatggattccccggcgagcaagggcatgggcggcgccatttcgatg
ggctacgacccctacgacttcttgacctcggtagtacgaccagaagggaaacggtagagacgcgctttggctccaagcaggagctcgtgaa
catgataaacaccgcccacgctacggcatcaaggtcgcgagacatagtaataaccaccgcgccggaggagaccttgagtgaacccct
tcgtcaatgactacacctggacgggacttctgaaggtcgttcggcaagtagacggccaattacctcgacttccaccgaacgagctccatgc
ggcgatttcgggaacatttggaggctatcccagacatatgccacgacaagagctgggaccagtactggctctgggccagccaggagagctac
gcggcatatctcaggagcatcggcatcgatgcctggcgcttcgactacgtcaagggtatgctccctgggtcgtcaaggactggctgaactggt
ggggaggctggcggttggagagtactgggacaccaacgtcagcgtgttctcaactgggcatactcagcgggtgccaaggtctttgacttcg
ccctctactacaagatggatgaggcctttgacaacaaaacattccagcgtcgtctcgtccctcagaacggccagactgtgtctcccgac
ccgttcaaggccgtaacctttgtagcaaacacgacaccgatataatctggaacaagatccagcctacgcgttcacctcacctacgaggggcc

Figure 16A



gcccgaacaatttctaccgcgactacgaggagtggctcaacaaggataagctcaagaacctcatctggatacatgacaacctcgccggagga
agcactgacatcggttactacgacaacgacgagctgatattcgtgagaacggctacggaagcaagccgggactgataacatacatcaacctc
gcctcaagcgaagccggaaggtgggtctacgttccgaagtcgcgggagcgtgcatccacgagtacaccggcaacctcgccgggtgggtgg
acaagtgggtggactcaagcgggtgggtgtacctgaggccctgcccacgacccggccaacggctattacggctactccgtctggagctatt
cgcggtgtgggtga

SEQ ID NO.: 4

Met Ala Lys Tyr Leu Glu Leu Glu Gly Gly Leu Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Met
Gly Gly Ile Trp Trp Asp Thr Ile Ala Gln Lys Ile Pro Asp Trp Ala Ser Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly
Tyr Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala
Ala Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Ala Pro Trp Val
Val Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala
Val Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Ala Leu Tyr Tyr Lys Met Asp Glu
Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn
Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr
Tyr Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Ala Ser Ser Glu Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala His Asp Pro Ala Asn Gly Tyr Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 5

atggccaagtactccgagctggaagagggcgcggtataatgcaggccttactgggacgtcccaggtggaggaatctgggtgggacacat
caggagcaagataccggagtggtacgaggcggaatatccgccatttggattccccggcaagcaagggcatgggcggcctattcgtatg
ggctacgacccctacgactctcttgacctcgggtgagtagcaccagaaggggaacggtagagacgcgcttgggtccaagcaggagctcgtgaa
catgataaacaccgcccacgcctatggcatgaaggaatagccgatatagtcatcaaccaccgcccggcggtgacctggagtgaacccct
cgtgaacgactatacctggaccgacttctcaaaggtcgcgtcgggtaaatacacggccaactacctcgaactccacccgaacgagctccatgc
ggcggtatccggaacatttggaggctatcccgacatatgccagacaagagctgggaccagtactggctctggccagccaggagagctac
gcggcatactcaggagcatcggcatcgatgcctggcgcttcgactacgtaagggtatgctccctgggtcgtcaaggactggctgaactgg
ggggaggctggcggttggagagtactgggacaccaacgtcgacgctgttctcaactgggcatactcagcgggtgccaaggtcttgcattcg
ccctctactacaagatggatgaggcctttgacaacaaaacattccagcgctcgtctctgcccttcagaacggccagactgttctccccgcgac
ccgttcaaggccgtaaccttttagcaaacacgacaccgataataatggaacaagtaccttgccttatgctttcatctcactcaagggccag
cccgtcatattctaccgcgaccacgaggagtggctcaacaaggacaggtgaacaacctcatatggatacacgaccacctcgaggtggaag
caccgacatagtctactacgataacgatgaactcatcttcaggaacggctacggggacaagccggggctataacctacatcaacctagggc
tcgagcaaggccggaaggtgggtttatgtgccgaagttcggggcgctgcattccacgagtatactgtaacctcggaggctgggtagacaa
gtacgtctactcaagcggtgggtctatctcgaagctccagcttacgacctgccaacgggcagtatggctactccgtgtggagctactgcggg
gtgggctga

SEQ ID NO.: 6

Met Ala Lys Tyr Ser Glu Leu Glu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Gly
Gly Gly Ile Trp Trp Asp Thr Ile Arg Ser Lys Ile Pro Glu Trp Tyr Glu Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Met Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly

Figure 16B



Asp Leu Glu Trp Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly
Tyr Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala
Ala Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Ala Pro Trp Val
Val Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala
Val Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Ala Leu Tyr Tyr Lys Met Asp Glu
Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Leu Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Val Ile Phe Tyr Arg Asp His Glu Glu Trp Leu Asn
Lys Asp Arg Leu Asn Asn Leu Ile Trp Ile His Asp His Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr
Tyr Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Asp Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Gly Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Tyr Val Tyr Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala Tyr Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 9

atggccaagtactccgagctggaagagggcggtcctaataatgcaggccttctactgggacgtcccatgggaggaatctggtgggacacgat
agcccagaagatacccgactgggcaagcgccgggatttcggcgatattgattccccggcgagcaagggcatgggcggcctattcgatg
ggctacgacccctacgactctcttgacctcgggtgagtagcagaccagaaggggaacggtagagacgcgctttggctccaagcaggagctcgtgaa
catgataaacacggcccatgcctacggcataaagggtcatagcggacatcgtcataaaccaccgcgcaggcggagacctcgagtgaacccg
ttcgttggggactacacctggacggacttctcaaaaggtggcctcgggcaaatatactgccaactacctcgaactccacccgaacgagctccatg
cgggcgattccggaacatttggaggctatcccacatatgccacgacaagagctgggaccagtactggctctgggcccagccaggagagctac
gcggcatactcaggagcatcggcatcgtatgcttggcgcttcgactacgtcaagggctatgctccctgggtcgtcaaggactggctgaactggt
ggggaggctgggcggttggagagtactgggacaccaacgtcgacgctgtttcactgggcatactcagcgggtccaaggtctttgacttcg
cccttactacaagatggacgaggccttcgataacaacaattccccgccttggtggacgccctcagatacggtcagacagtggtcagccgcg
acccgttaaggctgtgacgtttgtagccaaccacgataccgataatactggaacaagtatccagcctacgcgttcacctcacctacgagggc
cagccgacaataattctaccgcgactacgaggagtggctcaacaaggataagctcaagaacctcatctggatacatgacaacctcgcggagg
aagcactgacatcgtttactacgacaacgacgagctgatattcgcgagaacgggtacggaagcaagccgggactgataacatacatcaacct
cgctcaagcaaagccggaaggtgggtttacgttcgaagttcgaggctcgtgcatacacgagtagacaccggcaatctcgggcggtgggtgg
acaagtgggtgactcaagcggtgggtctacctcgaggctcctgccacgacccggccaacggccagtaggctactccgtctggagctac
tgcggtgttgggtga

SEQ ID NO.: 10

Met Ala Lys Tyr Ser Glu Leu Glu Glu Gly Gly Leu Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Met
Gly Gly Ile Trp Trp Asp Thr Ile Ala Gln Lys Ile Pro Asp Trp Ala Ser Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly
Tyr Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala
Ala Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Ala Pro Trp Val
Val Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala
Val Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Ala Leu Tyr Tyr Lys Met Asp Glu
Ala Phe Asp Asn Asn Asn Ile Pro Ala Leu Val Asp Ala Leu Arg Tyr Gly Gln Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn
Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr
Tyr Asp Asn Asp Glu Leu Ile Phe Ala Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Ala Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His Glu

Figure 16C



Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala His Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 11

atggccaagtacctggagctcgaggagggcgggctcataatgcaggccttctactgggacgtccccatgggaggaatctgggtgggacacgat
agcccagaagatacccgactgggcaagcgccgggatttcggcgatatggattccccggcgagcaagggcattggcgccctatttcgatg
ggctacgacccctacgacttctttgacctcggtgagtacgaccagaagggaacggtagagacgcgctttggctccaagcaggagctcgtgaa
catgataaacaccgcccacgcctatggcatgaaggaatagccgatatagtcatcaaccaccgcgcggcggtgacctggagtgaacccct
cgtgaacgactatacctggaccgacttctcaaggtcgcgctcggttaatacacggccaactacctgacttccacccgaacgagctccatgc
ggcgattccggaacatttggaggctatcccacatatgccacgacaagagctgggaccagtactggctctggggcagccaggagagctac
gcggcatatctcaggagcatcgccatcgatgcctggcgcttcgactacgtcaagggtatgctccctgggtcgtaaggactggctgaactgg
ggggaggctggcggttgagagtagtactgggacaccaacgtcgacgctgttctcaactgggcatactcgagcgggtccaaggtctttgacttcg
ccctctactacaagatggacgagggccttcgataacaacaacattcccgcctgggtggacgccctcagatacggtcagacagtggtcagccgcg
acccgttcaaggctgtgacgttttagccaaccacgataccgatataatctggaacaagtatccagcctacgcgttcacctcacctacgagggc
cagccgacaatatctaccgcgactacgaggagtggctcaacaaggatacgtcaagaacctcatctggatacatgacaacctcgccggagg
aagcacgagcatagtctactacgacagcgacgagatgatcttcgtgaggaaaggctatggaagcaagcctggccttataacttacatcaacctc
ggctcgagcaaggttggaaggtgggtctacgtccgaaggtcggggagcgtgcattccacgagtagacccggcaacctcgccggctgggtg
acaagtggtggactcaagcgggtgggtgtacctcgaggccccctgccacgacccggccaacggctattacggctactccgtctggagctac
tgcggtgttgctga

SEQ ID NO.: 12

Met Ala Lys Tyr Leu Glu Leu Glu Gly Gly Leu Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Met
Gly Gly Ile Trp Trp Asp Thr Ile Ala Gln Lys Ile Pro Asp Trp Ala Ser Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Met Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly
Tyr Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala
Ala Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Ala Pro Trp Val
Val Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala
Val Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Ala Leu Tyr Tyr Lys Met Asp Glu
Ala Phe Asp Asn Asn Asn Ile Pro Ala Leu Val Asp Ala Leu Arg Tyr Gly Gln Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn
Lys Asp Thr Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Ser Ile Val Tyr
Tyr Asp Ser Asp Glu Met Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Gly Ser Ser Lys Val Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala His Asp Pro Ala Asn Gly Tyr Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 13

atggccaagtacctggagctcgagagggcggggtcataatgcaggcgttctactgggacgtgccttcaggaggaatattgggtgggacacaat
acggcagaagataccggagtgtgacgatgccggaatctccgcaatatggattccccggcgagcaagggcattggcgccctatttcgatg
ggctacgacccctacgacttctttgacctcggtgagtatgaccagaagggaacggtagagacgcgctttggctccaagcaggagctcgtgaac
atgataaacacggcatgcctacggcataaaggctatagcggacatcgctataaacaccgcgcaggcgagacctcgagtgaacccgtt
cgttggggactacacctggacggacttctcaagggtggcctcgggcaataatactgccaactacctgacttccaccccaacgaggtcaagt
ctgtgacgagggcacatttggaggcttcccagacatagcccacgagaagagctgggaccagcactggctctggcgagcgatgagagctac
gccgcctacctaaaggagcatcgccgttgatgcctggcgcttcgactacgtcaagggtctacggagcgtgggtcgtaaggactggctggactg
gtggggaggctgggcccgtggggagtactgggacacaaacgttgatgcactgtcactgggcctactcgagcgatgcaaaagtcttcgactt

Figure 16D



ccgctctactacaagatggatgaggccttgacaacaaaacattccagcgtcgtctctgccctcagaacggccagactgtgtctcccgcg
accggttcaaggccgtaaccttttagcaaaccacgacaccgatataatctggaacaagtatccagcctacgcgttcacctacacacgagg
ccagccgacaatattctaccgcgactacgaggagtggctcaacaaggataagctcaagaacctcatctggatacatgacaacctcgccggag
gaagcactgacatagctactacgataacgatgaactcatcttcgtcaggaacggctacggggacaagccggggttataacctacatcaacct
aggctcgagcaaggccggaaggtgggttatgtgccgaagttcgcgggcgctgcatccacgagtatactggtaacctcgagggtgggttag
acaagtacgtctactcaagcggctgggtctatctgaagctccagcttacgacctgccaacgggcagtatggctactccgtgtggagctactg
cgggtgttgctga

SEQ ID NO.: 14

Met Ala Lys Tyr Leu Glu Leu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Ser
Gly Gly Ile Trp Trp Asp Thr Ile Arg Gln Lys Ile Pro Glu Trp Tyr Asp Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Val Lys Cys Cys Asp Glu Gly Thr Phe Gly
Gly Phe Pro Asp Ile Ala His Glu Lys Ser Trp Asp Gln His Trp Leu Trp Ala Ser Asp Glu Ser Tyr
Ala Ala Tyr Leu Arg Ser Ile Gly Val Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp
Val Val Lys Asp Trp Leu Asp Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp
Ala Leu Leu Asn Trp Ala Tyr Ser Ser Asp Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp
Glu Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val Ser
Arg Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro
Ala Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu
Asn Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Asp Ile Val
Tyr Tyr Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Asp Lys Pro Gly Leu Ile Thr Tyr
Ile Asn Leu Gly Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His
Glu Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Tyr Val Tyr Ser Ser Gly Trp Val Tyr Leu Glu
Ala Pro Ala Tyr Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 15

atggccaagtactccgagctggaagagggcgggctcataatgcaggccttctactgggacgtcccatgggaggaatctgggtgggacacgat
agcccagaagatacccgactgggcaagcgcgggatttcggcgatattgattccccggcgagcaagggcattggcgggcgctattcgatg
ggctacgaccctacgacttctttgacctcggtagtacgaccagaagggaacggtagagacgcgtttgggtccaagcaggagctcgtgaa
catgataaacacggccccatgcctacggcataaaggatcatagcggacatcgtcataaaccaccgcgcaggcgaggacctcgagtgaacccg
ttcgttggggactacacctggacggacttctcaaaaggtggcctcgggcaatatactgccaactacctcgacttccaccgaacgagctccatg
cgggcgattccggaacatttggaggctatcccacatatgccacgacaagagctgggaccagtactggctctgggccagccaggagagctac
gcggcatatctcaggagcatcggcacgatgccttggcgcttcgactacgtcaagggtacggagcgtgggtcgtaaggactggctggactg
gtggggaggtggggcgctcggggagtactgggacacaaacgttgatgcactgctcaactgggcctactcgagcgatgcaaaagcttcgactt
cccgtctactacaagatggatgaggcctttgacaacaaaacattccagcgtcgtctctgcccttcagaacggccagactgtgtctcccgcg
accggttcaaggccgtaaccttttagcaaaccacgacaccgatataatttgaacaagtaccggcctacgccttcacctcacctacgaggg
ccagccgacgatattctaccgcgactacgaggagtggctcaacaaggacaggctcaagaacctcatctggatacacgaccaccttgcgggtg
gaagcactgacatcgtttactacgacaacgacgagctgatattcgtgagaacggctacggaagcaagccgggactgataacatacatcaacc
tcgcctcaagcaagccggaaggtgggttatgtgccgaagttcgcgggcgctgcatccacgagtatactggtaacctcgagggtgggttag
acaagtacgtctactcaagcggctgggtctatctcgaagctccagcttacgacctgccaacgggcagtatggctactccgtgtggagctattgc
ggtgttggtga

SEQ ID NO.: 16

Met Ala Lys Tyr Ser Glu Leu Glu Gly Gly Leu Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Met
Gly Gly Ile Trp Trp Asp Thr Ile Ala Gln Lys Ile Pro Asp Trp Ala Ser Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp



Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly
Tyr Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala
Ala Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp Val
Val Lys Asp Trp Leu Asp Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala
Leu Leu Asn Trp Ala Tyr Ser Ser Asp Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Glu
Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn
Lys Asp Arg Leu Lys Asn Leu Ile Trp Ile His Asp His Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr
Tyr Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Ala Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Tyr Val Tyr Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala Tyr Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

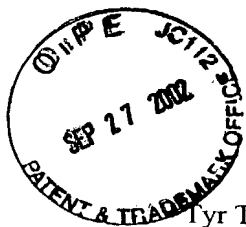
SEQ ID NO.: 17

atggccaagtactccgagctggaagggggcgggctcataatgcaggccttctactgggacgtcccatgggaggaatctggtgggacacgat
agcccagaagatacccgactgggcaagcgcgggatttcggcgatatggattccccggcgagcaagggcatggcgggcgctattcgatg
ggctacgacccctacgacttctttgacctcggtgagtacgaccaggagggaacggtagagacgcgctttggctccaagcaggagctcgtgaa
catgataaacacggcccatgcctacggcataaaggctatagcggacatcgtcataaaccaccgcgcaggcggagacctcgagtgaacccg
ttcgttggggactacacctggacggacttctcaaggtggcctcgggcaaatatactgccaactacctcgacttccacccaacgaggtcaagt
gctgtgacgagggcacatttggaggcttcccagacatagcccacgagaagagctgggaccagcactggctctggcgagcgatgagagcta
cgccgctactcaaggagcatcggttgatgcttggcgcttgactacgtcaagggtacggagcgtgggtcgtcaaggactggctggact
gggtggggaggtgggcccgtcggggagtactgggacacaaacgttgatgcactgctcaactgggcctactcgagcgatgcaaaagcttcgac
ttcccgtctactacaagatggacgcggcctttgacaacaagaacattcccgactcgtcgaggccctcaagaacgggggcacagtcgtcagc
cgcgaccctgttaaggccgtaaccttcgttgcaaacacgacaccgatataatctggaacaagtatccagcctacgcgttcacctcacctacga
gggccagccgacaatattctaccgcgactacgaggagtggctcaacaaggataagctcaagaacctcatctggatacatgacaacctgccg
gaggaagcacgagcatagttactacgacagcgacgagatgatcttcgtgaggaacggctatggaagcaagcctggccttataacttacatcaa
cctcggtcgcagcaaggttggaaggtgggtttacgttcggaaggttcgcaggctcgtgcatacacgagtacaccggcaatctcggcggtgggt
ggacaagtgggtggactcaagcggctgggtctacctcgaggctcctgccacgacccggccaacggccagtacggctacctcgtctggagc
tactgcggtgttgggtga

SEQ ID NO.: 18

Met Ala Lys Tyr Ser Glu Leu Glu Gly Gly Gly Leu Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Met
Gly Gly Ile Trp Trp Asp Thr Ile Ala Gln Lys Ile Pro Asp Trp Ala Ser Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Glu Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Val Lys Cys Cys Asp Glu Gly Thr Phe Gly
Gly Phe Pro Asp Ile Ala His Glu Lys Ser Trp Asp Gln His Trp Leu Trp Ala Ser Asp Glu Ser Tyr
Ala Ala Tyr Leu Arg Ser Ile Gly Val Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp
Val Val Lys Asp Trp Leu Asp Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp
Ala Leu Leu Asn Trp Ala Tyr Ser Ser Asp Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp
Ala Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Glu Ala Leu Lys Asn Gly Gly Thr Val Val Ser
Arg Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro
Ala Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu
Asn Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Ser Ile Val

Figure 16F



Tyr Tyr Asp Ser Asp Glu Met Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr
Ile Asn Leu Gly Ser Ser Lys Val Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His
Glu Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu
Ala Pro Ala His Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 19

atggccaagtacctggagctcgaagagggcgggctcataatgcaggccttctactgggacgtcccatgggaggaatctggtgggacacgat
agcccagaagatacccagctgggcaagcgccgggatttcggcgatatggattcctcccgagcaagggtatgagcggcggtattcgatgg
gctacgacccctacgattatfttgaccttggtgagtactaccagaagggaacggtggaaacgaggttcggctcaaagcaggagctcataaacat
gataaacacggcccatgcctacggcataaaggctcatagcggacatcgtcataaaccaccgcgcaggcggagacctcgagtgaacccgttc
gttggggactacacctggacggacttctcaaagggtggcctcgggcaatatactgccaactacctcgacttccaccgaacgagctccatgcg
ggcgattccgggaacatttgaggctatcccacatatgccacgacaagagctgggaccagtactggctctgggccagccaggagagctacgc
ggcatatctcaggagcatcgccatcgatgcctggcgcttcgactacgtcaagggtatgctccctgggtcgtaaggactggctgaactggtgg
gggggctggcggttgagagtactgggacaccaacgtcgacgctgttctcaactgggcatactcgagcgggtccaaggtctttgacttcgcc
cttactacaagatggatgaggccttgacaacaaaacattccagcgctcgtctctgcccttcagaacggccagactgtgtctcccgagacc
gttcaaggccgtaaccttttagcaaacacgacaccgatataatttgaacaagtaccggcctacgccttcacctcacctacgaggggccag
ccgacgatattctaccgcgactacgaggagtggctcaacaaggacaggctcaagaacctcatctggatacacgaccacctcgccggttgaag
cactgacatcgtttactacgacaacgacgagctgatattctgtgagaaaggctacggaagcaagccgggactgataacatacatcaacctgc
ctcaagcaaaagccggaaggtgggtttatgtgccgaagttcgcgggcgctgcatccacgagcactactggaacctcgaggctgggtagaca
agtacgtctactcaagcggctgggtctatctcgaagctccagcttacgacctgccaacgggcagtatggctactccgtgtggagctactgcgg
tgttgctga

SEQ ID NO.: 20

Met Ala Lys Tyr Leu Glu Leu Glu Gly Gly Leu Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Met
Gly Gly Ile Trp Trp Asp Thr Ile Ala Gln Lys Ile Pro Asp Trp Ala Ser Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Tyr Phe Asp
Leu Gly Glu Tyr Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Ile Asn Met
Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp
Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr
Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly Tyr
Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala Ala
Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Ala Pro Trp Val Val
Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala Val
Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Ala Leu Tyr Tyr Lys Met Asp Glu Ala
Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val Ser Arg Asp
Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala Tyr
Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn Lys
Asp Arg Leu Lys Asn Leu Ile Trp Ile His Asp His Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr Tyr
Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile Asn
Leu Ala Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His Glu His
Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Tyr Val Tyr Ser Ser Gly Trp Val Tyr Leu Glu Ala Pro
Ala Tyr Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 21

atggccaagtactccgagctggaagagggcggcgttataatgcaggccttctactgggacgtccaggtggaggaatctggtgggacaccat
caggagcaagataccggagtgtacgagcggggaatatccgccatttgattcctccgggagcaagggtatgagcggcggtattcgatgg
gctacgacccctacgatgatttgacctgggtgagtactaccagaagggaacggtggaaacgaggttcggctcaaagcaggagctcataaac
atgataaacacggcccatgcctacggcataaaggctcatagcggacatcgtcataaaccaccgcgcaggcggagacctcgagtgaacccgtt
cgttggggactacacctggacggacttctcaaagggtggcctcgggcaatatactgccaactacctcgacttccaccgaacgagctccatgc
ggcgattccgggaacatttgagggtatcccacatatgccacgacaagagctgggaccagtactggctctgggccagccaggagagctac

Figure 16G



gcgggtatatctcaggagcatcggcatcgatgcctggcgcttcgactacgtcaagggtctacggagcgtgggtcgtcaaggactggctggactg
gtggggaggctggccgtcggggagtactgggacacaaacgttgatgcactgctcaactgggcctactcgagcgatgcaaaagtcttcgactt
cccgtctactacaagatggatgaggcctttgacaacaaaacattccagcgctcgtctctgcccttcagaacggccagactgtgtctcccgcg
accgttcaaggccgtaaccttttagcaaacacgacaccgatataatttgaacaaagtaccggcctacgccttcacctacactacgaggg
ccagccgacgataattctaccgcgactacgaggagtggctcaacaaggacaggtcagaacacctcatctggatacacgactacctcgcgggtg
gaagcactgacatcgtttactacgacaacgacgagctgatattcgtgagaacggctacggaagcaagccgggactgataacatacaaac
tcgctcaagcaagccggaggtgggttatgtgccgaagtgcggggcgctgcatccacgagtatactggtaacctcggaggtgtag
acaagtacgtctactcaagcggtgggtctatctcgaagctccagcttacgacctgccaacgggcagtatggctactccgtgtggagctc
gggtttggctga

SEQ ID NO.: 22

Met Ala Lys Tyr Ser Glu Leu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Gly
Gly Gly Ile Trp Trp Asp Thr Ile Arg Ser Lys Ile Pro Glu Trp Tyr Glu Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Gly Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Asp Leu Asp
Leu Gly Glu Tyr Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Ile Asn Met
Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp
Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr
Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly Tyr
Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala Val
Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp Val Val
Lys Asp Trp Leu Asp Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala
Leu Leu Asn Trp Ala Tyr Ser Ser Asp Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Glu
Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn
Lys Asp Arg Leu Lys Asn Leu Ile Trp Ile His Asp Tyr Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr
Tyr Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Ala Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Tyr Val Tyr Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala Tyr Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 23

atggccaagtactccgagctggaagagggcggttatagtgcaggccttctactgggacgtccaggtggaggaatctgggtggacaccat
caggagcaagataccggagtggtacgaggcggaatatccgccatttggattccccggcgagcaagggtcgtggcgccctattcgtatg
ggctacgacccctacgacttcttgacctcgggtgagtacgaccagaagggaacggtagagacgcgtttggctccaagcaggagctcgtgaa
catgataaacacggcccatgcctacggcataaaggtcatagcggacatcgtcataaaccaccgcgcaggcgaggacctcagtggaacccg
ttcgttggggactacacctggacggacttctcaaggtggcctcgggcaatatactgccaactacctcgaacttcacccgaacgagctccatg
cgggcgattcgggaacatttggaggctatcccgacatgcccagacagaagagctgggaccagtagtggctctggccagccaggagagctac
gcggcatatctcaggagcatcggcatcgatgcctggcgcttcgactacgtcaagggtctacggagcgtgggtcgtcaaggactggctggactg
gtggggaggctggccgtcggggagtactgggacacaaacgttgatgcactgctcaactgggcctactcgagcgatgcaaaagtcttcgactt
cccgtctactacaagatggatgaggcctttgacaacaaaacattccagcgctcgtctctgcccttcagaacggccagactgtgtctcccgcg
accgttcaaggccgtaaccttttagcaaacacgacaccgatataatctggaacaaagtaccagcctacgcgttcacctacactacgaggg
ccagccgacaatattctaccgcgactacgaggagtggctcaacaaggataagctcaagaacctcatctggatacatgacaacctcgcggag
gaagcatgagcatagtttactacgacagcgacgagatgtctcgtgagggaacggctatggaagcaagcctggccttataacttacatcaacct
ggctcgagcaaggttgaaggtgggtctacgttccgaagttcgcgggagcgtgcatccacgagtacaccggcaacctcggcggtgggtgg
acaagtggtgggtaacgcgggtgggtgtacctcgaagggccctgcccacgacccggccaacggctattacgggtactccgtctggagctatt
cggtgttggctga

SEQ ID NO.: 24

Figure 16H



Met Ala Lys Tyr Ser Glu Leu Glu Glu Gly Gly Val Ile Val Gln Ala Phe Tyr Trp Asp Val Pro Gly
Gly Gly Ile Trp Trp Asp Thr Ile Arg Ser Lys Ile Pro Glu Trp Tyr Glu Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly
Tyr Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala
Ala Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp Val
Val Lys Asp Trp Leu Asp Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala
Leu Leu Asn Trp Ala Tyr Ser Ser Asp Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Glu
Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn
Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Met Ser Ile Val Tyr
Tyr Asp Ser Asp Glu Met Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Gly Ser Ser Lys Val Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala His Asp Pro Ala Asn Gly Tyr Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

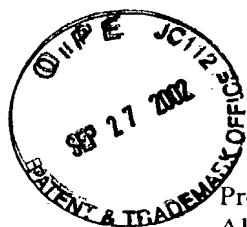
SEQ ID NO.: 25

atggccaagtacgtggagctcgaagagggcggggctcataatgcaggccttctactgggacgtcccatgggaggaatctggtgggacacgat
agcccagaagatacccgactgggcaagcgccgggatttcggcgatatggattctctcccgagcaagggtatgagcggcggtctattcgatgg
gctacgacccctacgattattttgacctcgggtgagtactaccagaaggggaacgggtggaacagaggttcggctcaaagcaggagctcataaacat
gataaacaccgcccacgcctatggcatgaaggaatagccgatatagtcatcaaccaccgcggcggtgacctggagtgaaccccttcgt
gaacgactatacctggaccgacttctcaaaggtcgcgtcgggtaaatcacggccaactacctgacttccaccgaacgagctccatcgggg
cgattccggaacatttgaggctatcccgcacatgccacgacaagagctgggaccagctactggctctgggccaagcaggagactacgcgg
catatctcaggagcatcggcatcgatgcctggcgcttcgactacgtcaagggtatgctccctgggtcgtaaggactggctgaactggtggg
aggctgggcggttgagagtactgggacaccaacgtcgacgctgttctcaactgggcatactcgagcgggtccaaggtctttgacttcgccctc
tactacaagatggacgaggccttcgataacaacaacattcccgcctgggtgggcgccctcagatacggctcagacagtggtcagccgcgaccc
gttcaaggctgtgacgtttgtagccaaccacgataccgatataatctggaacaagtatccagcctacgcgttcacctacacgaggccagc
cgacaatatctaccgcgactacgaggagtggctcaacaaggataagctcaagaacctcatctggatacatgacaacctgccggaggaagc
accgacatagtctactacgataacgatgaactcatcttcgtaggcacggctacggggacaagccggggttataacctacatcaacctaggct
cgagcaaggccggaaggtgggtttacgttccgaagttcgaggctcgtgcatacacgagtagcaccggcaatctcggcggtgggtggacaa
gtgggtggactcaagcggctgggtctacctcgaggtcctgcccacgaccggccaacggccagtagcggctactccgtctggagctattgcg
gtgttgggtga

SEQ ID NO.: 26

Met Ala Lys Tyr Leu Glu Leu Glu Gly Gly Leu Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Met
Gly Gly Ile Trp Trp Asp Thr Ile Ala Gln Lys Ile Pro Asp Trp Ala Ser Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Tyr Phe Asp
Leu Gly Glu Tyr Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Ile Asn Met
Ile Asn Thr Ala His Ala Tyr Gly Met Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp
Leu Glu Trp Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr
Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly Tyr
Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala Ala
Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Ala Pro Trp Val Val
Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala Val
Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Ala Leu Tyr Tyr Lys Met Asp Glu Ala
Phe Asp Asn Asn Ile Pro Ala Leu Val Gly Ala Leu Arg Tyr Gly Gln Thr Val Val Ser Arg Asp

Figure 16I



Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala Tyr
Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn Lys
Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr Tyr
Asp Asn Asp Glu Leu Ile Phe Val Arg His Gly Tyr Gly Asp Lys Pro Gly Leu Ile Thr Tyr Ile Asn
Leu Gly Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His Glu Tyr
Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu Ala Pro
Ala His Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 27

atggcaaatgattccgagctcgaagagggcggcggtataatgcaggccttctactgggacgtcccaggtggaggaatctggtgggacaccatc
aggagcaagataccggagtggtacgagggcggaatatccgccatttgattcctcccgagcaagggtatgagcggcggtattcgaagg
ctacgacccctacgattattttgacctgggtgagtactaccagaagggaacgggtgaaacagggttcggctcaaagcaggagctcataaacatg
ataaacacggcccatgcctacggcataaaggctatagcggacatcgtcataaaccacggcgagggcgagacctgagtgaacccgttcgt
tggggactacacctggacggacttctcaaagggtggcctcgggcaaatatactccaactacctcgacttccacccgaacgagctccatgcggg
cgattccggaacatttgagggtatcccgacatatgccacgacaagagctgggaccagtactggctctgggccagccaggagagctacgagg
catactcaggagcatcggcatcgatgcctggcgcttcgactacgtcaagggtatgctcctgggtcgtcaaggactggctgaactggtgggg
aggctggggcggttgagagtactgggacaccaacgtcgacgctgttctcaactgggcatactcgagcgggtccaaggctttgacttcgcctc
tactacaagatggacggcgcccttgacaacaagaacattcccgactcgtcgaggccctcaagaacgggggcacagtcgtcagccgcgacc
cgtttaaggccgtaaccttctgttcaaaccacgacaccgatataatctggaacaagtatccagcctacgcgttcacctcacctacgaggggcag
ccgacaatattctaccgcgactacgaggagtggctcaacaaggataagctcaagaacctcatctggatacatgacaacctcgccggaggaag
cactgacatcgtttactacgacaacgacgagctgatattcgtgagaacgggtacggaagcaagccgggactgataacatacatcaacctcgc
gtcaagcaaaagccggaagggtggtttacgttccgaagttcgagggtcgtgcatacacgagtagacaccggcaatctcggcggtggtggaca
agtgggtggactcaagcgggtggtgtctacctcagggtcctgccacgacccggccaacggccagtagcggctactcgtctggagctactgc
ggtgttgggtga

SEQ ID NO.: 28

Met Ala Lys Tyr Ser Glu Leu Glu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Gly
Gly Gly Ile Trp Trp Asp Thr Ile Arg Ser Lys Ile Pro Glu Trp Tyr Glu Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Tyr Phe Asp
Leu Gly Glu Tyr Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Ile Asn Met
Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp
Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr
Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly Tyr
Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala Ala
Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Ala Pro Trp Val Val
Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala Val
Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Ala Leu Tyr Tyr Lys Met Asp Ala Ala
Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Glu Ala Leu Lys Asn Gly Gly Thr Val Val Ser Arg Asp
Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala Tyr
Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn Lys
Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr Tyr
Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile Asn
Leu Ala Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His Glu Tyr
Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu Ala Pro
Ala His Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 29

atggcaaatgattccgagctcgaagagggcggcggtataatgcaggccttctactgggacgtcccaggtggaggaatctggtgggacaccggt
agccagaagatacccgactgggcaagcgccgggatttcggcgatatggattccccggcgagcaagggtatggcgccgctattcgaagg
ggctacgacccctacgacttcttgacctcgggtgagtacgaccagaagggaacggtagagacgcgcttggctccaagcaggagctcgtgaa

Figure 16J



SEQ ID NO.: 32

Met Ala Lys Tyr Ser Glu Leu Glu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Gly
Gly Gly Ile Trp Trp Asp Thr Ile Arg Ser Arg Ile Pro Glu Trp Tyr Glu Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly C
Asp Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Ly
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly
Tyr Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala
Ala Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp Val
Val Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala
Leu Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Glu
Ala Phe Asp Asn Asn Asn Ile Pro Ala Leu Val Asp Ala Leu Arg Tyr Gly Gln Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn
Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Ser Ile Val Tyr
Tyr Asp Ser Asp Glu Met Ile Phe Val Arg Thr Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Gly Ser Ser Lys Val Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Tyr Val Tyr Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala Tyr Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 33

atggccaagtactccgagctggaagagggcggggtcataatgcaggcgttctactgggacgtgccttcaggaggaatatggtgggacacaat
acggcagaagataccggagtggtacgatcccggaatctccgcaatatggattctcccgagcaagggtatgagcggcggtattcctgatgg
gctacgacctacgattatgttgcctcggtagtactaccagaagggaacgggtggaaacgaggttcggctcaaagcaggagctcataaacat
gataaacacggcccatgctacggcataaagggtcatagcggacatcgtcataaaccaccgcgcaggcggagacctcagtggaacccgttc
gttggggactacacctggacggactctcaaagggtggcctcgggcaatatactgccaactacctcgaactccacccgaacgagctccatgcg
ggcgattccgggaacatttgagggtatcccgacatgacacgacaagagctgggaccagtactggctctgggccagccaggagagctacgc
ggcatatctcaggagcatcggcatcgtgctggtgactacgtgaagggtacggagcgtgggtcgtcaaggactggctcaactggtg
ggcggtggtggcggttgagtagtgggacaccaacgttgatgcactcctcaactgggctactcagcggcgccaagggtcttcgactttcc
gctctactacaagatggacgcggcctttgacaacaagaacattccgcactcgtcagggcctcaagaacgggggcacagtcgtcagccgcg
accggttaaggccgtaacctcgttgcaaacacgacacccgatataatctggaccaagtacgttgccttatgctttcatcctacctacgaaggcca
gcccgtcatattctaccgcgactacgaggagtggctcaacaaggacaggttgaaacacccatattgatacacgaccacctcgcaggtggaag
caccgacatagctactacgataacgatgaactcatcttcgtaggaacgggtacggggacaagccggggccttataacctacatcaacctagc
tcgagcaaggccggaagggtgggttacgttccgaagttcgcaggctcgtgcatacacgagtacaccggcaatctcggcggtggtgggacaa
gtgggtggactcaagcggctgggtctacctcgaggtcctgccacgacccggccaacggccagtacggctactcgtctggagctactgcg
gtgttggtga

SEQ ID NO.: 34

Met Ala Lys Tyr Ser Glu Leu Glu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Ser
Gly Gly Ile Trp Trp Asp Thr Ile Arg Gln Lys Ile Pro Glu Trp Tyr Asp Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Tyr Phe Asp
Leu Gly Glu Tyr Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Ile Asn Met
Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp
Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr
Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly Tyr
Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala Ala
Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp Val Val
Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala

Figure 16K



catgataaacacggcccatgcctacggcataaaggctcatagcggacatcgtcataaaccaccgcgcaggcggagacctcgagtggaacccg
ttcgttggggactacacctggacggacttctcaaagggtggtctcgggcaaatatactgccaactacctcgacttccacccgaacgagctccatgc
ggcgattccggaacatttggaggctatcccacatatgccacgacaagagctgggaccagtactggctctggggccagccaggagagctac
gcggcataatctcaggagcatcggcatcgatgcctggcgcttcgactacgtcaagggtatgctccctgggtcgtcaaggactggctgaactggt
ggggagggtggcggttgagagtagtgggacaccaacgtcgacgctgttctcaactgggcatactcgagcgggtccaagggtttgacttcg
cccttactacaagatggatgaggccttgacaacaaaaacattccagcgcctcgtctccttcagaacggccagactgtgtctcccgagac
ccgttcaaggccgtaaccttttagcaaacacgacaccgatataatctggaacaagtacctgttatgcttcatcctcacctacgaaggccag
cccgtcatattctaccgcgactacgaggagtggctcaacaaggacagggtgaacaacctcatatggatacacgaccacctcgagggggaag
caccgacatagtctactacgataacgatgaactcatcttcgtcaggaacggctacggggacaagccggggttataacctacatcaacctagcg
tcgagcaaggccggaagggtgggtttatgtccgaagttcgcgggcgcgtgcatccacgagtatactgtaacctcggaggctgggtagacaa
gtacgtctactcaagcggctgggtctatctcgaagctccagcttacgacctgccaacgggcagtatggctactccgtgtggagctactcggt
gttgggtga

SEQ ID NO.: 30

Met Ala Lys Tyr Leu Glu Leu Glu Gly Gly Leu Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Met
Gly Gly Ile Trp Trp Asp Thr Val Ala Gln Lys Ile Pro Asp Trp Ala Ser Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Val Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly
Tyr Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala
Ala Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Ala Pro Trp Val
Val Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala
Val Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Ala Leu Tyr Tyr Lys Met Asp Glu
Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Leu Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Val Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn
Lys Asp Arg Leu Asn Asn Leu Ile Trp Ile His Asp His Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr
Tyr Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Asp Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Gly Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Tyr Val Tyr Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala Tyr Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 31

atggcaaaagtactccgagctggaagagggcgcggttataatgcaggccttctactgggacgtcccaggtggaggaatctggtgggacaccat
caggagcaggataccggagtggtagaggcggaatatccgccatttggattccccggcgagcaagggcatggcgccgctattcgatg
ggctacgacccctacgacttctttgacctggtagtagcaccagaagggaacggtagagacgcgttggctccaagcaggagctcgtgaa
catgataaacacggcccatgcctacggcataaaggctcatagcggacatcgtcataaaccaccgcgcaggcggagacctcgagtggaacccg
ttcgttggggactacacctggacggacttctcaaagggtggcctcgggcaaatatactgccaactacctcgacttccacccgaacgagctccatg
cggcgattccggaacatttggaggctatcccacatatgccacgacaagagctgggaccagtactggctctggggccagccaggagagctac
gcggcataatctcaggagcatcggcatcgatgcctggcgctttgactacgtgaagggtacggagcgtgggtcgtcaaggactggctcaactgg
tggggcggtggggcgttggcgagtactgggacaccaacgttgatgactcctcaactgggcctactcgagcggcgccaagggtcttcgacttc
ccgcttactacaagatggacgaggccttcgataacaacaacattcccgccttggtagcgcctcagatacggtagacagtggtcagccgc
gacccgttcaaggctgtgacgttttagccaaccacgataccgatataatctggaacaagtatccagcctacgcgttcatcctcacctacgaggg
ccagccgacaattattcaccgcgactacgaggagtggctcaacaaggataagctcaagaacctatctggatacatgacaacctggccggag
gaagcacgagcatagttactacgacagcgacgagatgatcttcgtgaggaccggctatggaagcaagcctggccttataacttacaacact
cggctcgagcaagggtggaagggtgggtttatgtccgaagttcgcgggcgcgtgcatccacgagtatactgtaacctcggaggctgggtaga
caagtagcttactcaagcggctgggtctatctcgaagctccagcttacgacctgccaacgggcagtatggctactccgtgtggagctattgcg
gtgtggctga

Figure 16L



Appln No.: 10/081,872

Page 38 of 116

Applicant(s): Walter Callen et al.

ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

Leu Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Ala
Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Glu Ala Leu Lys Asn Gly Gly Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Thr Lys Tyr Leu Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Val Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn
Lys Asp Arg Leu Asn Asn Leu Ile Trp Ile His Asp His Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr
Tyr Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Asp Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Gly Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala His Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 35

atggccaagtactccgagctggaagagggcggtgtataatgcaggccttctactgggacgtccagggtggaggaatctggtgggacaccat
caggagcaagataccggagtggtacgagggggaatatccgccatttgattccccggcgagcaagggcatgggcggcgccatttcgatg
ggctacgacccctacgacttcttgacctcggtgagtagcaccagaaggggaacggtagagacgcgcttggctccaagcaggagctcgtgaa
catgataaacaccgccacgcctacggcatcaaggtcatcgacacatagtaataaccaccgcgcggaggagaccttgagtggaaacccct
tcgtcaatgactacacctggacggacttctgaaggtcgcttccggcaagtacacggccaactacctgacttccaccccaacgaggtcaagtg
ctgtgacgagggcacatttgagggttccagacatagcccacgagaagagctgggaccagcactggctctggcgagcgatgagagctac
gccgcctacctaaggagcatcggcggttgatgcctggcgcttcgactacgtcaagggctatgctccctgggtcgtaaggactggctgaactggt
ggggagggtggcggttgagagtactgggacaccaacgtcgacgctgttctcaactgggcatactcgagcgggtccaaggtcttggacttcg
ccctctactacaagatggacgcggccttgacaacaagaacattccgcactcgtcgaggccctcaagaacgggggcacagtcgtcagccgc
gacccgttaaggccgtaaccttcgttgcaaacacgacaccgatataatctggaacaagtatccagcctacgcgttcacctcacctacgaggg
ccagccgacaatattctaccgcgactacgaggagtggctcaacaaggataagctcaagaacctcatctggatacatgacaacgtcgccggag
gaagcaccgacatagctactacgataacgatgaactcatcttcgtcaggaacggctacggggacaagccggggttataacctacatcaacct
agggtcgagcaaggccggaaggtgggttacgttccgaagttcgaggctcgtgcatacacgagtacaccggcaatctcggcggtggtggtg
acaagtgggtgactcaagcggtgggttacctcgaggctcctgccacgacccggccaacggccagtacggctactcgtctggagctac
tgcggtgttgggtga

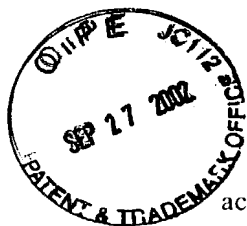
SEQ ID NO.: 36

Met Ala Lys Tyr Ser Glu Leu Glu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Gly
Gly Gly Ile Trp Trp Asp Thr Ile Arg Ser Lys Ile Pro Glu Trp Tyr Glu Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Val Lys Cys Cys Asp Glu Gly Thr Phe Gly
Gly Phe Pro Asp Ile Ala His Glu Lys Ser Trp Asp Gln His Trp Leu Trp Ala Ser Asp Glu Ser Tyr
Ala Ala Tyr Leu Arg Ser Ile Gly Val Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Ala Pro Trp
Val Val Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp
Ala Val Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Ala Leu Tyr Tyr Lys Met Asp
Ala Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Glu Ala Leu Lys Asn Gly Gly Thr Val Val Ser
Arg Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro
Ala Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu
Asn Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Val Ala Gly Gly Ser Thr Asp Ile Val
Tyr Tyr Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Asp Lys Pro Gly Leu Ile Thr Tyr
Ile Asn Leu Gly Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His
Glu Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu
Ala Pro Ala His Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 71

atggccaagtactccgagctggaagagggcggtgtataatgcaggccttctactgggacgtcccttcaggaggaatctggtgggacacaat

Figure 16M



Appin No.: 10/081,872

Applicant(s): Walter Callen et al.

ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

Page 39 of 116

acggcagaagataccggagtggtacgatgccggaatctccgcaatatggattccccggcgagcaagggcattggcgccgctattcga
ggctacgacccctacgacttcttgacctcggtgagtagcaccagaagggaacggtagagacgcgctttggctccaagcaggagctcgtgaa
catgataaacacggcccatgcctacggcataaaggatcatagcggacatcgtcataaaccaccgcgcaggcggagacctcgaagtgaacccg
ttcgttggggactacacctggacggacttctcaaaggtagcctcgggcaaatatactgccaactacctcgacttccaccgaacgagctccatg
cgggcgattccggaacatttggaggctatcccgacatagccacgacaagagctgggaccagtactggctctgggccagccaggagagctac
gcggcatactcaggagcatcggcatcgatgcctggcgcttcgactacgtcaagggtatgctccctgggtcgtaaggactggctgaactggt
ggggaggctggcggttgagagtagtgggacaccaacgtcgacgctgttctcaactgggcatactcgagcgggtccaaggctttgacttcg
cccttactacaagatggatgaggcctttgacaacaaaaacattccagcgctcgtctctgccctcagaacggccagactgttctcccgac
ccgttcaaggccgtaaccttttagcaaacacacacccgatataatctggaacaagtatccagcctacgcgttcacctcacctacgagggcc
agccgacaatattctaccgcgactacgaggagtggtcacaaggataagctcaagaacctatctggatacatgacaacctcgccggagga
agcactgacatcgttactacgacaacgacgagctgatattcgtgagaaacggctacggaagcaagccgggactgataacatacatcaacctc
gcctcaagcaaaagccggaagggtgggttatgtgccgaagttcgcgggcgcggtcatccacgagtagtatactggtaacctcgagggtgggtaga
caagtacgttactcaagcggctgggtctatctcgaagctccagcttacgacctgccaacgggcagtagtggtactccgtgtgagctactgc
ggggtgggctga

SEQ ID NO.: 72

Met Ala Lys Tyr Leu Glu Leu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Ser
Gly Gly Ile Trp Trp Asp Thr Ile Arg Gln Lys Ile Pro Glu Trp Tyr Asp Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly
Tyr Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala
Ala Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Ala Pro Trp Val
Val Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala
Val Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Ala Leu Tyr Tyr Lys Met Asp Glu
Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn
Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr
Tyr Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Ala Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Tyr Val Tyr Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala Tyr Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

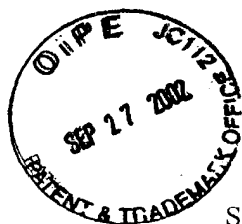
SEQ ID NO.: 49

gtggttatgacgatgtccgctatgacctttatgccgtaggcatgggccgtgtttatcatgttcacgagctcctgcttgagccaaagcgcgtctct
accgttcccttctggctgtactcaccgaggtcaaagaagtcgtaggggtcgtagcccatcgaataggcgcgcccatgcccttgcctgccggg
ggaatccatcgcggaaatccggcgcttgcccgatcggttatctctgggctatcgtgtccaccagattcctccatggggacgtccagta
gaaggcctgcattatgagcccgccctcttcgagcccggaatactttgccataagttacctcctactagtagattaaaattctgttctgtgaaatt
gtt

SEQ ID NO.: 50

Val Val Tyr Asp Asp Val Arg Tyr Asp Leu Tyr Ala Val Gly Met Gly Arg Val Tyr His Val His Glu
Leu Leu Leu Gly Ala Lys Ala Arg Leu Tyr Arg Ser Leu Leu Val Leu Thr Glu Val Lys Glu Val
Val Gly Val Val Ala His Arg Ile Gly Ala Ala His Ala Leu Ala Arg Arg Gly Asn Pro Tyr Arg Arg
Asn Pro Gly Ala Cys Pro Val Gly Tyr Leu Leu Gly Tyr Arg Val Pro Pro Asp Ser Ser His Gly Asp
Val Pro Val Glu Gly Leu His Tyr Glu Pro Ala Leu Phe Glu Pro Gly Ile Leu Cys His Lys Leu Pro
Pro Thr Ser Arg Leu Lys Phe Cys Phe Leu Cys Glu Ile Val

Figure 16N



SEQ ID NO.: 51

ATGGCCAAGTACCTGGAGCTCGAAGAGGGCGGGGTCATAATGCAGGCGTTCTACTGGG
ACGTGCCTTCAGGAGGAATATGGTGGGACACAATACGGCAGAAGATACCGGAGTGGT
ACGATGCCGGAATCTCCGCAATATGGATTCCCCCGGCGAGCAAGGGCATGGGCGGCGC
CTATTTCGATGGGCTACGACCCCTACGACTTCTTTGACCTCGGTGAGTACGACCAGAAG
GGAACGGTAGAGACGCGCTTTGGCTCCAAGCAGGAGCTCGTGAACATGATAAACACC
GCCCACGCCTATGGCATGAAGGTAATAGCCGATATAGTCATCAACCACCGCGCCGGCG
GTGACCTGGAGTGGAAACCCCTTCGTGAACGACTATACCTGGACCGACTTCTCAAAGGT
CGCGTCGGGTAAATACACGGCCAACCTACCTCGACTTCCACCCCAACGAGGTCAAGTGC
TGTGACGAGGGCACATTTGGAGGCTTCCCAGACATAGCCCACGAGAAGAGCTGGGAC
CAGCACTGGCTCTGGGCGAGCGATGAGAGCTACGCCGCCTACCTAAGGAGCATCGGCG
TTGATGCCTGGCGCTTTGACTACGTGAAGGGCTACGGAGCGTGGGTCTGTCGAAGGACTG
GCTCAACTGGTGGGCGGCTGGGCGGTGGGCTGAGTACTGGGACACCAACGTTGATGCA
CTCCTCAACTGGGCGCTACTCGAGCGCGGCCAAGGTCTTCGACTTCCCCTCTACTACAA
ATGGATGAGGCGCTTTGACAACAAAAACATTCCAGCGCTCGTCTCTGCCCTTCTAGAAC
GGCCAGACTGTTGTCTCCCGCGACCCGTTCAAGGCCGTAACCTTTGTAGCAAACACG
ACACCGATATAATCTGGAACAAGTATCCAGCCTACGCGTTCTCTCACCTACGAGGG
CCAGCCGACAATATTCTACCGCGACTACGAGGAGTGGCTCAACAAGGATAAGCTCAAG
AACCTCATCTGGATACATGACAACCTCGCCGGAGGAAGCACTGACATCGTTTACTACG
ACAACGACGAGCTGATATTCTGTGAGAAACGGCTACGGAAGCAAGCCGGGACTGATAA
CATAATCAACCTCGCCTCAAGCAAAGCCGGAAGGTGGGTTTACGTTCCGAAGTTCGC
AGGCTCGTGATACACGAGTACACCGGCAATCTCGGCGGCTGGGTGGACAAGTGGGTG
GACTCAAGCGGCTGGGTCTACCTCGAGGCTCCTGCCACGACCCGGCCAACGGCCAGT
ACGGCTACTCCGTCTGGAGCTATTGCGGTGTTGGCTGA

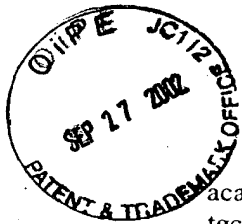
SEQ ID NO.: 52

MAKYLELEEGGVIMQAFYWDVPSGGIWWDITIRQKIPWYDAGISAIWIPPASKGMGGAYS
MGYDPYDFDLGEYDQKGTVETFRGSKQELVNMINTAHAYGMKVIADIVINHRAGGDLE
WNPVNDYTWTDVSKVASGKYTANYLDFHPNEVKCCDEGTFGGFPDIAHEKSWDQHWL
WASDESYAAYLRSIGVDAWRFDYVKGYGAWVKDWLNWWGGWAVGEYWDTNVDAL
LNWAYSSGAKVDFPLYKMDAEDFNKNIPALVLSALQNGQTVVSRDPFKAVTFVANHDT
DIIWNKYPAYAFILTYEQPTIFYRDYEEWLNDKDKLKNLIWIHDNLGGSTDIVYYDNDLI
FVRNGYGSKPLITYINLASSKAGRWVYVPKFAGSCIHEYTGNLGGWVDKWVDSSGWVY
LEAPAHDPANGQYGYSVWSYCGVG

SEQ ID NO.: 37

atggccaagtacctggagctcgaagagggcggggtcataatgcaggcgttctactgggacgtgccttcaggaggaatatggtgggacacaat
acggcagaagataccggagtggtacgatgccggaatctccgcaatatggattccccggcgagcaagggcatgggcggcgctattcgatg
ggctacgaccctacgacttcttgacctcgtgagtagaccagaagggaacggtagagacgcgctttggctccaagcaggagctcgtgaa
catgataaacaccgcccacgcctatggcatgaaggtaatagccgatatagtcatcaaccaccgcgcggcggtgacctggagtgaacccctt
cgtgaacgactatacctggaccgacttctcaaaggctcgcgtcggtgaaatacacggccaactacctcgacttccaccgaacgagctccatgc
ggcgattccggaacatttgaggctatcccgacatatgccacgacaagagctgggaccagtactggctctgggccagcaggagagctac
gcggcatatctcaggagcatcggcatcgatgcctggcgctttgactacgtgaagggtacggagcgcgggtcgtaaggactggctcaactg
gtggggcggtggcggtggcggtgagtagtgggacccaacgttgatgactcctcaactgggctactcgagcggcgccaaggctctcgact
cccgtctactacaagatggatgaggcctttgacaacaaaacattccagcgctcgtctctgcccttcagaacggccagactgtgtctccgcg
accggttcaaggccgtaaccttttagcaaacacgacaccgatataatctggaacaagtatccagcctacgcgttcatctcactacgaggg
ccagccgacaatatctatcgcgactacgaggagtggtcaacaaggataagctcaagaacctcatctggatacatgacaacctcgccggagg
aagcactgacatcgtttactacgacaacgacgagctgatattcgtgagaacggctacggaagcaagccgggactgataacatacatcaacct
cgctcaagcaaacgggaaggtgggtttacgttccgaagtcgcaggctcgtgcatacacgagtagaccggcaatctcgcggtggtggtg

Figure 160



acaagtgggtggactcaagcggctgggtctacctcgaggctcctgcccacgacccggccaacggccagctacggctactccgtctggagctac
tgcgggggtgggggtga

SEQ ID NO.: 38

Met Ala Lys Tyr Leu Glu Leu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Ser
Gly Gly Ile Trp Trp Asp Thr Ile Arg Gln Lys Ile Pro Glu Trp Tyr Asp Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Met Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly
Tyr Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala
Ala Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Arg Val
Val Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala
Leu Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Glu
Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn
Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr
Tyr Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Ala Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala His Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 39

atggccaagtacctggagctcgaagagggcggggtcataatgcaggcgttctactgggacgtgccttcaggaggaatatggtgggacacaat
acggcagaagataccggagtggtacgatgccggaatctccgcaatatggattcctcccgagcaggggtatgagcggcggtattcgatgg
gtactagacccctacgattattttgacctcggtagtactaccagaaggggaacgggtggaacgaggttcggctcaaagcaggagctcataaacat
gataaacaccgcccacgacctatggcatgaaggaatagccgatatagtcatcaaccaccgcgccggcggtgacctggagtggaaccccttcgt
gaacgactataacctggaccgacttctcaaaagtcgcgtcgggtaaatacacggccaactacctcgaactccaccgaacgagctccatgcggg
cgattccggaacatttggaggtatcccgacatatgccagacaaagagctgggaccagtactggctctgggccagccaggagagctacgcgg
catatctcaggagcatcgggtatcgatgcctggcgcttggactacgtgaagggtacggagcgtgggtcgtcaaggactggctcaactggtggg
gcgggtgggcccgttggcgagtactgggaccccaacgttgatgcctcctccctgggctactcagcggcgccaaggtcttcgaactcccg
tctactacaagatggatgaggcctttgacaacaaaaacattccagcgcgtcgtctctgcccttcagaacggccagactgtgtctcccgacccg
ttcaaggccgtaacctttgtagccaaccacgataccgataatctggaacaagatccagcctacgcgttcacctcacctacgagggccagcc
gacaatattctaccgcgactacgaggagtggctcaacaaggataagctcaagaacctcatctggatacatgacaacctcgcggaggaagca
ccgacatagctactacgataacgatgaactcatcttcgtaggaacgggtacggggacaagccggggcttataacctacatcaacctaggctc
gagcaaggccgggaaggtgggtctacgttcgaagttcggggagcgtgcatccacgagtacaccggcaacctcggcggtgggtggacaa
gtgggtggactcaagcgggtgggtgtacctcgaaggccctgccacgacccggccaacggctattacggctactccgtctggagctactgcg
gggtgggctga

SEQ ID NO.: 40

Met Ala Lys Tyr Leu Glu Leu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Ser
Gly Gly Ile Trp Trp Asp Thr Ile Arg Gln Lys Ile Pro Glu Trp Tyr Asp Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Arg Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Tyr Phe Asp
Leu Gly Glu Tyr Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Ile Asn Met
Ile Asn Thr Ala His Ala Tyr Gly Met Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp
Leu Glu Trp Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr
Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly Tyr
Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala Ala

Figure 16P

Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Cly Tyr Gly Ala Trp Val Val
Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Pro Asn Val Asp Ala Leu
Leu Pro Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Glu Ala
Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val Ser Arg Asp
Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala Tyr
Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn Lys
Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr Tyr
Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Asp Lys Pro Gly Leu Ile Thr Tyr Ile Asn
Leu Gly Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His Glu Tyr
Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu Ala Pro
Ala His Asp Pro Ala Asn Gly Tyr Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 41

atggccaagtacctggagctgaagagggcggtcataatgcaggcgttctactgggacgtgccttcaggaggaatatggggacacaat
acggcagaagataccggagtggtacgatccggaatctccgcaatatggattcctcccgagcaagggtatgagcggcggtattcgatgg
gctacgaccctacgattattttgacctcggtgagtactaccagaagggaacgggtgaaacgaggttcggctcaaacgaggagctcataaacat
gataaacacggccatgcctacggcataaaggtcatagcggacatcgtcataaaccaccgcgcaggcggagacctcgagtgaaccggtc
gttggggactacacctggacggacttctcaaggtggcctcgggcaaatatactgccaactacctcgacttccaccgaacgagctccatgcg
ggcgattccggaacatttgaggctatcccgacatatgccacgacaagagctgggaccagtactggctctggccagccaggagagctacgc
ggcatactcaggagcatcggcatcgtatgcctggcgctttgactacgtgaagggctacggagcgtgggtcgtcaaggactggctcaactgggtg
ggcgggctggggcggttgccgagtactgggacaccaacgttgatgcactcctcaactgggcctactcgagcggcgccaaggtcttgcactccc
gctctactacaagatggacgcggcctttgacaacaagaacattcccgactcgtcaggccctcaagaacgggggcacagtcgtcagccgcg
accggttaaggccgtaaccttctgtgcaaaccacgacaccgatataatctggaacaagtatccagcctacgcgttcacctcacctacgagggc
cagccgacaatatctaccgcgactacgaggagtggctcaacaaggataagctcaagaacctcatctggatacatgacaacctcgccggagg
aagcacgagcatagttactacgacagcgacgagatgatcttctgtgaggaacggctatggaagcaagcctggccttataacttacatcaacctc
ggctcgagcaaggttggaaggtgggttatgtgccgaagttcgcgggcgctgcatccacgagtatactggttaacctcggaggctgggtagac
aagtacgtctactcaagcggtgggtctatctcgaagctccagcttacgacctgccaacgggcagtagtggtactccgtgtggagctactcg
gtgttgggtga

SEQ ID NO.: 42

Met Ala Lys Tyr Leu Glu Leu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Ser
Gly Gly Ile Trp Trp Asp Thr Ile Arg Gln Lys Ile Pro Glu Trp Tyr Asp Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Tyr Phe Asp
Leu Gly Glu Tyr Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Ile Asn Met
Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp
Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr
Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly Tyr
Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala Ala
Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp Val Val
Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala
Leu Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Ala
Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Glu Ala Leu Lys Asn Gly Gly Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn
Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Ser Ile Val Tyr
Tyr Asp Ser Asp Glu Met Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Gly Ser Ser Lys Val Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Tyr Val Tyr Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala Tyr Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

Figure 16Q



SEQ ID NO.: 43

atggccaagtactccgagctggaagagggcggttataatgcaggccttctactgggacgtcccaggtggaggaatctggtgggacaccat
caggagcaagataccggagtggtacgagggcggaatatccgccatttggattccccggcgagcaagggcatggcgggcgcttattcgatg
ggctacgaccttacgacttcttgacctcggtagtacgaccagaagggaacggtagagacgcgtttggctccaagcaggagctcgtgaa
catgataaacacggcccatgctacggcataaagggtcatagcggacatcgtcataaaccaccgcgcaggcgagacctcagtggaacccg
ttcgttggggactacacctggacggacttctcaaagggtggcctcgggcaaatatactccaactacctcgaactccacccaacagggtcaagt
gctgtgacgagggcacatttggaggcttcccagacatagcccacgagaagagctgggaccagcactggctctggcgagcgatgagagcta
cgccgcctacctaaggagcatcggtgatgcttggcgttcgactacgtcaagggtacggagcgtgggtcgtcaaggactggctggact
ggtggggaggtggcggtcggggagtactgggacacaaacgttgatgcactgctcaactgggctactcagcgatgcaaaagtcttcgac
tccccgtctactacaagatggatgaggcctttgacaacaaaacattccagcgtcgtctctgccctcagaacggccagactgtgtctccgc
gacctgtcaaggccgtaacctttgtagcaaacacgacaccgatataatctggaacaagtatccagcctacgcgttcacctcacctacgagg
gccagccgacaatatctaccgcgactacgaggagtggtcaacaaggataagctcaagaacctcatctggatacatgacaacctcgtcggag
gaagcacgacatgatttactacgacgcgacgagatgatcttctgtaggaacggctatggaagcaagcctggccttataacttacatcaacct
cggctcagcaaggttgaaggtgggtttacgttccgaagttcgaggctcgtgcatacacgagtagacaccggcaatctcggcggtcgtggtgg
acaagtgggtgactcaagcggtgggtctacctcgaggctcctgccacgacccggccaacggccagtagcggtactccgtctggagctac
tgcggtgttggtga

SEQ ID NO.: 44

Met Ala Lys Tyr Ser Glu Leu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Gly
Gly Gly Ile Trp Trp Asp Thr Ile Arg Ser Lys Ile Pro Glu Trp Tyr Glu Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Val Lys Cys Cys Asp Glu Gly Thr Phe Gly
Gly Phe Pro Asp Ile Ala His Glu Lys Ser Trp Asp Gln His Trp Leu Trp Ala Ser Asp Glu Ser Tyr
Ala Ala Tyr Leu Arg Ser Ile Gly Val Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp
Val Val Lys Asp Trp Leu Asp Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp
Ala Leu Leu Asn Trp Ala Tyr Ser Ser Asp Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp
Glu Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val Ser
Arg Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro
Ala Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu
Asn Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Val Gly Gly Ser Thr Ser Ile Val
Tyr Tyr Asp Ser Asp Glu Met Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr
Ile Asn Leu Gly Ser Ser Lys Val Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His
Glu Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu
Ala Pro Ala His Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 45

atggccaagtactccgacctggaagagggcggttataatgcaggccttctactgggacgtcccaggtggaggaatctggtgggacaccat
caggagcaagataccggagtggtacgagggcggaatatccgccatttggattccccggcgagcaagggcatggcgggcgcttattcgatg
ggctacgaccttacgacttcttgacctcggtagtacgaccagaagggaacggtagagacgcgtttggctccaagcaggagctcgtgaa
catgataaacacggcccatgctacggcataaagggtcatagcggacatcgtcataaaccaccgcgcaggcgagacctcagtggaacccg
ttcgttggggactacacctggacggacttctcaaagggtggcctcgggcaaatatactccaactacctcgaactccacccaacagggtcaagt
gctgtgacgagggcacatttggaggcttcccagacatagcccacgagaagagctgggaccagcactggctctggcgagcgatgagagcta
cgccgcctacctaaggagcatcggtgatgcttggcgtttgactacgtgaagggtacggagcgtgggtcgtcaaggactggctcaactg
gtggggcggtggcggttggcgagtactgggacaccaacgttgatgcactcctcaactgggctactcagcgcgccaaaggtcttcgactt
ccgctctactacaagatggatgaggcctttgacaacaaaacattccagcgtcgtcgtctgccctcagaacggccagactgtgtctccgcg
accgttcaaggccgtaacctttgtagcaaacacgacaccgatataatctggaacaagtatccagcctacgcgttcacctcacctacgagg
ccagccgacaatatctaccgcgactacgaggagtggtcaacaaggataagctcaagaacctcatctggatacatgacaacctcgcggag

Figure 16R



gaagcaccgacatagtctactacgataacgatgaactcatcttcgtcaggaacggctacggggacaagccggggccttataacctacatcaacct
aggctcgagcaaggccggaaggtgggttatgtgccgaagttcgcgggcgctgcatccacgagtatactggtaacctcggaggctgggtag
acaagtacgtctactcaagcggtcgggtctatctcgaagctccagcttacgacctcgccaacgggcagtatggctactccgtgtggagctattgc
gggttggtgga

SEQ ID NO.: 46

Met Ala Lys Tyr Ser Asp Leu Glu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Gly
Gly Gly Ile Trp Trp Asp Thr Ile Arg Ser Lys Ile Pro Glu Trp Tyr Glu Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Val Lys Cys Cys Asp Glu Gly Thr Phe Gly
Gly Phe Pro Asp Ile Ala His Glu Lys Ser Trp Asp Gln His Trp Leu Trp Ala Ser Asp Glu Ser Tyr
Ala Ala Tyr Leu Arg Ser Ile Gly Val Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp
Val Val Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp
Ala Leu Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp
Glu Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val Ser
Arg Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro
Ala Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu
Asn Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Asp Ile Val
Tyr Tyr Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Asp Lys Pro Gly Leu Ile Thr Tyr
Ile Asn Leu Gly Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His
Glu Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Tyr Val Tyr Ser Ser Gly Trp Val Tyr Leu Glu
Ala Pro Ala Tyr Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 47

atggccaagtacaccgagctggaagagggcggttataatgcaggccttctactgggacgtccaggtggaggaatctgggtgggacaccat
caggagcaagataccggagtgtacgagcggaatatccgccatttgattccccggcgagcaagggtatggcgggcgctattcgtatg
ggctacgacctacgaattctttgacctcggtagtacgaccagaagggaaacggtagagacgcgtttggctccaagcaggagctcgtgaa
catgataaacaccgcccacgcctatggcatgaaggtaatagccgatatagtcatcaaccaccgcccggcggtgacctggagtgaacccctt
cgtgaacgactatacttgaccgacttctcaaaggtcgcgtcggttaatacacggccaactacctcgaacttccacccaacgaggtcaagt
ctgtgacgagggcacatttgaggcttcccagacatagcccacgagaagagctgggaccagcactggctctggcgagcgatgagagctac
gccgctacctaaggagcatcggttgatgcttggttgactacgtgaagggtacggagcgtgggtcgtaaggactggctcaactgg
tggggcggttggcggttggtgagctactgggacaccaacgttgatgactcctcaactgggcctactcgagcggcgccaaggtcttcgacttc
ccgctctactacaagatggatgaggcctttgacaacaaaaattccagcgcctcgtctcgtcccttcagaacggccagactgtgtctcccgga
cccgttcaaggccgtaaccttttagcaaacacgacacggatataatctggaacaagtaccttgcttatgctttcactcctacacgaaggcca
gcccgtcatattctaccgcgactacgaggagtggctcaacaaggacaggttgaaacacctcatatggatacacgaccacctcgagggtggaag
cacgagcatagttactacgacagcgacgagatgatctcgtgaggaaacggctatggaagcaagcctggccttataacttacatcaacctcggt
cgagcaaggttggaaggtgggttacgtccgaagttcgagggcgtcatcacgagtagcaccggcaatctcggcggtgggtggacaag
tgggtggactcaagcggtcgggtctacctcgaggtcctgcccacgaccggccaacggccagtaggctactcgtctggagctactcggtg
tgttggtgtag

SEQ ID NO.: 48

Met Ala Lys Tyr Thr Glu Leu Glu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Gly
Gly Gly Ile Trp Trp Asp Thr Ile Arg Ser Lys Ile Pro Glu Trp Tyr Glu Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Met Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys

Figure 16S



Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Val Lys Cys Cys Asp Glu Gly Thr Phe Gly
Gly Phe Pro Asp Ile Ala His Glu Lys Ser Trp Asp Gln His Trp Leu Trp Ala Ser Asp Glu Ser Tyr
Ala Ala Tyr Leu Arg Ser Ile Gly Val Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp
Val Val Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp
Ala Leu Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp
Glu Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val Ser
Arg Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Leu
Ala Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Val Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu
Asn Lys Asp Arg Leu Asn Asn Leu Ile Trp Ile His Asp His Leu Ala Gly Gly Ser Thr Ser Ile Val
Tyr Tyr Asp Ser Asp Glu Met Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr
Ile Asn Leu Gly Ser Ser Lys Val Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Pro Cys Ile His
Glu Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu
Ala Pro Ala His Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 53

ATGGCCAAGTACTCCGAGCTGGAAGAGGGCGGCGTTATAATGCAGGCCTTCTACTGGG
ACGTCCCAGGTGGAGGAATCTGGTGGGACACCATCAGGAGCAAGATACCGGAGTGGT
ACGAGGCGGGAATATCCGCCATTTGGATTCCCCCGGCGAGCAAGGGCATGGGCGGCG
CCTATTTCGATGGGCTACGACCCCTACGACTTCTTTGACCTCGGTGAGTACGACCAGAA
GGGAACGGTAGAGACGCGCTTTGGCTCCAAGCAGGAGCTCGTGAACATGATAAACAC
GGCCCATGCCTACGGCATAAAGGTCATAGCGGACATCGTCATAAACCACCGCACAGGC
GGAGACCTCGAGTGGAACCCGTTCTGTTGGGGACTACACCTGGACGGACTTCTCAAAGG
TGGCCTCGGGCAAATATACTGCCAACTACCTCGACTTCCACCCCAACGAGGTCAAGTG
CTGTGACGAGGGCACATTTGGAGGCTTCCCAGACATAGCCCACGAGAAGAGCTGGGA
CCAGCACTGGCTCTGGGCGAGCGATGAGAGCTACGCCGCTACCTAAGGAGCATCGGC
GTTGATGCCTGGCGCTTCGACTACGTCAAGGGCTACGGAGCGTGGGTCTGTCAGGACT
GGCTGGACTGGTGGGGAGGCTGGGCCGTCGGGGAGTACTGGGACACAAACGTTGATG
CACTGCTCAACTGGGCCTACTCGAGCGATGCAAAAGTCTTCGACTTCCCGCTCTACTAC
AAGATGGATGAGGCCTTTGACAACAAAAACATTCCAGCGCTCGTCTCTGCCCTTCAGA
ACGGCCAGACTGTTGTCTCCCGCGACCCGTTCAAGGCCGTAACCTTTGTAGCAAACCA
CGACACCGATATAATCTGGAACAAGTATCCAGCCTACGCGTTCATCCTCACCTACGAG
GGCCAGCCGACAATATTCTACCGCGACTACGAGGAGTGGCTCAACAAGGATAAGCTCA
AGAACCTCATCTGGATACATGACAACCTCGCCGGAGGAAGCACTGACATCGTTTACTA
CGACAACGACGAGCTGATATTCGTGAGAAACGGCTACGGAAGCAAGCCGGGACTGAT
AACATACATCAACCTCGCCTCAAGCAAAGCCGGAAGGTGGGTCTACGTTCCGAAGTTC
GCGGGAGCGTGCATCCACGAGTACACCGGCAACCTCGGCGGCTGGGTGGACAAGTGG
GTGGACTCAAGCGGGTGGGTGTACCTCGAGGGCCCTGCCACGACCCGGCCAACGGCT
ATTACGGCTACTCCGTCTGGAGCTACTGCGGTGTTGGCTGA

SEQ ID NO.: 54

MAKYSELEEGVIMQAFYWDVPGGGIWWDITIRSKIPEWYEAGISAIWIPPASKGMGGAYS
MGYDPYDFFDLGEYDQKGTVETFRGSKQELVNMINTAHAYGIKVIADIVINHRTGGDLEW
NPFVGDYTWDFSKVASGKYTANYLDFHPNEVKCCDEGTFGGFPDIAHEKSWDQHWLW
ASDESYAAYLRSIGVDAWRFDYVKGYGAWVVKDWLDWWGGWAVGEYWDTNVDALL
NWAYSSDAKVFDPLYYKMDEAFDNKNIPALVSALQNGQTVVSRDPFKA VTFVANHDTD
IWNKYPAYAFILTYEGQPTIFYRDYEEWLNKDKLKNLIWIHDNLGGSTDIVYYDNDELIF
VRNGYGSKPGLITYINLASSKAGRWWYVPKFAGACIHEYTG NLGGWVDKWVDSSGWVY
LEAPAHDPANGYYGYSVWSYCGVG

SEQ ID NO.: 55

Figure 16T



ATGGCCAAGTACCTGGAGCTCGAGGAGGGCGGGGTCATAATGCAGGCGTTCTACTGGG
ACGTGCCTTCAGGAGGAATATGGTGGGACACAATACGGCAGAAGATACCGGAGTGGT
ACGATGCCGGAATCTCCGCAATATGGATTCCCCCGCGAGCAAGGGCATGGGCGGCGC
CTATTTCGATGGGCTACGACCCCTACGACTTCTTTGACCTCGGTGAGTACGACCAGAAG
GGAACGGTAGAGACGCGCTTTGGCTCCAAGCAGGAGCTCGTGAACATGATAAACACC
GCCCACGCCTATGGCATGAAGGTAATAGCCGATATAGTCATCAACCACCGCGCCGGCG
GTGACCTGGAGTGAACCCCTTCGTGAACGACTATACCTGGACCGACTTCTCAAAGGT
CGCGTCGGGTAAATACACGGCCAACCTACCTCGACTTCCACCCGAACGAGCTCCATGCG
GGCGATTCCGGAACATTTGGAGGCTATCCCGACATATGCCACGACAAGAGCTGGGACC
AGTACTGGCTCTGGGCCAGCCAGGAGAGCTACGCGGCATATCTCAGGAGCATCGGCAT
CGATGCCTGGCGCTTTGACTACGTGAAGGGCTACGGAGCGTGGGTCGTCAAGGACTGG
CTCAACTGGTGGGGCGGCTGGGCGGTTGGCGAGTACTGGGACACCAACGTTGATGCAC
TCCTCAACTGGGCCTACTCGAGCGGCGCCAAGGTCTTCGACTTCCCGCTCTACTACAAG
ATGGATGAGGCCTTTGACAACAAAAACATTCCAGCGCTCGTCTCTGCCCTTCAGAACG
GCCAGACTGTTGTCTCCCGCGACCCGTTCAAGGCCGTAACCTTTGTAGCAAACCACGA
CACCGATATAATCTGGAACAAGTACCTTGCTTATGCTTTCATCCTCACCTACGAAGGCC
AGCCCGTCATATTCTACCGCGACTACGAGGAGTGGCTCAACAAGGACAGGTTGAACAA
CCTCATATGGATACACGACCACCTCGCAGGTGGAAGCACGAGCATAGTTTACTACGAC
AGCGACGAGATGATCTTCGTGAGGAACGGCTATGGAAGCAAGCCTGGCCTTATAACTT
ACATCAACCTCGGCTCGAGCAAGGTTGGAAGGTGGGTTTACGTTCCGAAGTTCGCAGG
CTCGTGATACACGAGTACACCGGCAATCTCGGCGGCTGGGTGGACAAGTGGGTGGAC
TCAAGCGGCTGGGTCTACCTCGAGGCTCCTGCCCACGACCCGGCCAACGGCCAGTACG
GCTACTCCGTCTGGAGCTATTGCGGTGTTGGCTGA

SEQ ID NO.: 56

MAKYLELEEGGVIMQAFYWDVPSGGIWWDTIRQKIPEWYDAGISAIWIPPASKGMGGAYS
MGYDPYDFDLGEYDQKGTVETRFSGSKQELVNMINTAHAYGMKVIADIVINHRAGGDLE
WNPVFNDYTWTDFSKVASGKYTANYLDFHPNELHAGDSGTFGGYPDICHDKSWDQYWL
WASQESYAAYLRSIGIDAWRFDYVKGYGAWVVKDWLNWWGGWAVGEYWDTNVDALL
NWAYSSGAKVFDPLYYKMDEAFDNKNIPALVSALQNGQTVVSRDPKAVTFVANHDTF
IHWNKYLAAYFILTIEGQPVIFYRDYEEWLNKDRLNLIWIHDHLAGGSTSIVYYDSDEMIF
VRNGYGSKPLITYINLGS SKVGRWVYVPKFAGSCIHEYTG NLGGWVDKWVDSSGWVYL
EAPAHDPANGQYGYSVWSYCGVG

SEQ ID NO.: 57

ATGGCCAAGTACCTGGAGCTCGAAGAGAGCGGGGTCATAATGCAGGCGTTCTACTGGG
ACGTGCCTTCAGGAGGAATATGGTGGGACACAATACGGCAGAAGATACCGGAGTGGT
ACGATGCCGGAATCTCCGCAATATGGATTCTCCCGCGAGCAAGGGTATGAGCGGCGG
CTATTTCGATGGGCTACGACCCCTACGATTATTTTGACCTCGGTGAGTACTACCAGAAGG
GAACGGTGGAAACGAGGTTCCGGCTCAAAGCAGGAGCTCATAAACATGATAAACACCG
CCCACGCCTACGGCATCAAGGTATCGCAGACATAGTAATCAACCACCGCGCCGGAGG
AGACCTTGAGTGGAAACCCCTTCGTCAATGACTACACCTGGACCGACTTCTCGAAGGTC
GCTTCCGGCAAGTACACGGCCAACCTACCTCGACTTCCACCCCAACGAGGTCAAGTGCT
GTGACGAGGGGCACATTTGGAGGCTTCCCAGACATAGCCACGAGAAGAGCTGGGACC
AGCACTGGCTCTGGGCGAGCGATGAGAGCTACGCCGCCTACCTAAGGAGCATCGGCGT
TGATGCCTGGCGCTTTGACTACGTGAAGGGCTACGGAGCGTGGGTCGTCAAGGACTGG
CTCAACTGGTGGGGTGGCTGGGCGGTCGGGGAGTACTGGGACACAAACGTTGATGCAC
TGCTCAACTGGGCCTACTCGAGCGATGCAAAAGTCTTCGACTTCCCGCTCTACTACAAG
ATGGACGAGGCCTTCGATAACAACAACATTCCCGCCCTGGTGGACGCCCTCAGATACG
GTCAGACAGTGGTCAGCCGCGACCCGTTCAAGGCTGTGACGTTTGTAGCCAACCACGA

Figure 16U



CCGATATAATCTGGAACAAGTACCTTGCTTATGCTTTTCATCCTCACCTACGAAGGCC
AGCCCGTCATATTCTACCGCGACTACGAGGAGTGGCTCAACAAGGACAGGTTGAACAA
CCTCATATGGATACACGACCACCTCGCAGGTGGAAGCACTGACATCGTTTACTACGAC
AACGACGAGCTGATATTCGTGAGAAACGGCTACGGAAGCAAGCCGGGACTGATAACA
TACATCAACCTCGCCTCAAGCAAAGCCGGAAGGTGGGTCTACGTTCCGAAGTTCGCGG
GAGCGTGCATCCACGAGTACACCGGCAACCTCGGCGGCTGGGTGGACAAGTGGGTGG
ACTCAAGCGGGTGGGTGTACCTCGAGGCCCTGCCACGACCCGGCCAACGGCTATTA
CGGCTACTCCGTCTGGAGCTATTGCGGTGTTGGCTGA

SEQ ID NO.: 58

MAKYLELEESGVIMQAFYWDVPSGGIWWDITRQKIPEWYDAGISAIWIPPASKGMSGGYS
MGYDPYDYFDLGEYYQKGTVETRFGSKQELINMINTAHAYGIKVIADIVINHRAGGDLEW
NPFVNDYTWTDFSKVASGKYTANYLDFHPNEVKCCDEGTFGGFPDIAHEKSWDQHWLW
ASDESYAAYLRSIGVDAWRFDYVKGYGAWVKDWLNWWGGWAVGEYWDTNVDALL
NWAYSSDAKVDFPLYKMDAEDNINNIPALVDALRYGQTVVSRDPFKA VTFVANHDTD
IWNKYLAYAFILTYEQPVIFYRDYEEWLNKDRLNLIWIHDHLAGGSTDIVYYDNDELIF
VRNGYGSKPLITYINLASSKAGRWVYVPKFAGACIHEYTG NLGGWVDKWVDSSGWVY
LEPAHDPANGYYGYSVWSYCGVG

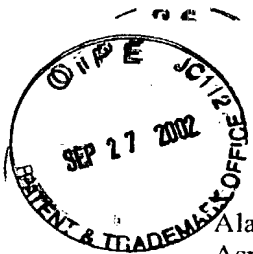
SEQ ID NO.: 59

atggccaagtacctggagctcgaagagggcggggtcataatgcaggcgttctactgggacgtgccttcaggaggaatatggtgggacacaat
acggcagaagataccggagtggtacgatccggaatctccgcaatatggattctcccgagcaagggtatgagcggcggtctattcgatgg
gtacgaccctacgattatttgacctcggtagtactaccagaagggaacgggtgaaacgaggttcggctcaaagcaggagctcataaacat
gataaacaccgcccacgctacggcatcaaggtcatcgagacatagtaataaccaccgcccggaggagacctgagtgaacccctcgc
tcaatgactacacctggacggacttctgaaggtcgttcggcaagtacacggccaactacctcgactccaccggaacgagctccatcg
gcatatctcaggagcatcgccatcgatgcctggcgcttcgactacgtcaagggtatgctccctgggtcgaaggactggctgaactggtggg
gaggtcggcggttgagagtagtgggacaccaacgtcgacgtgttctcaactgggcatactcgagcgggtccaaggctttgacttcgcct
ctactacaagatggacgagggccttcgataacaacaacattcccgccctggtggacgcccagatacggtcagacagtggtcagccgcgacc
cgttaaggctgtgacgtttgtagccaaccacgataccgatataatttgaacaagtaccggcctacgccttcacctcactacgagggccag
ccgacgatattctaccgcgactacgaggagtggctcaacaaggacagggtcaagaacctcatctggatacacgaccacctcgccggtggaag
cactgacatcgtttactacgacaacgacgagctgatattcgtgagaaacggctacggaagcaagccgggactgataacatacatcaacctcgc
gtcaagcaaagccggaaggtgggtttatgtgccgaaggtcgcgggcgctgcatccacgagtatactggaacctcggaggtgggtagaca
agtacgttactcaagcgggtgggtctatctgaagctccagcttacgacctgccaacgggcagtatggctactccgtgtggagctattgcggt
gttgggtga

SEQ ID NO.: 60

Met Ala Lys Tyr Leu Glu Leu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Ser
Gly Gly Ile Trp Trp Asp Thr Ile Arg Gln Lys Ile Pro Glu Trp Tyr Asp Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Tyr Phe Asp
Leu Gly Glu Tyr Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Ile Asn Met
Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp
Leu Glu Trp Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr
Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly Tyr
Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala Ala
Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Ala Pro Trp Val Val
Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala Val
Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Ala Leu Tyr Tyr Lys Met Asp Glu Ala
Phe Asp Asn Asn Asn Ile Pro Ala Leu Val Asp Ala Leu Arg Tyr Gly Gln Thr Val Val Ser Arg Asp
Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala Tyr

Figure 16V



Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn Lys
Asp Arg Leu Lys Asn Leu Ile Trp Ile His Asp His Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr Tyr
Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile Asn
Leu Ala Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His Glu Tyr
Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Tyr Val Tyr Ser Ser Gly Trp Val Tyr Leu Glu Ala Pro
Ala Tyr Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 61

atggccaagtactccgagctgaaaaagggcgggggtcataatgcaggcgttctactgggacgtgccttcaggaggaatatgggtgggacacaat
acggcagaagataccggagtggtacgagggcgggaatatccgccatttgattctctcccgagcaagggtatgagcggcggctattcgatgg
gctacgaccctacgattattttgacctcggtagtactaccagaagggaacgggtgaaacgaggttcggctcaaagcaggagctcataaacat
gataaacaccgcccacgctacggcatcaaggatcgcagacatagtaataaccaccgcgcggaggagaccttgagtggaaaccttcg
tcaatgactacacctggacgggacttctgaaggctcgttcggcaagtacacggccaactacctcaactccaccggaacgagctccatgcgg
gcatctccggaacatttgagggtatcccgacatatgccacgacaagagctgggaccagtactggctctgggccagccaggagagctacgcg
gcatatctcaggagcatcggcatcgtgctggcgcttcgactacgtcaagggtacggagcgtgggtcgtcaaggactggctggactgggtg
gggaggctggggcgtcggggagtagtgggacacaaacgttgatgcactgctcaactgggcctactcgagcgtgcaaaagtcttcgactccc
gctctactacaagatggatgaggcctttgacaacaaaaacattccagcgtcgtctctgccccttcagaacggccagactgttgtctccgcgacc
cgttcaaggccgtaaccttttagcaaacatgacaccgatataatctggaacaagatccagcctacgcgttcacctcacctacgaggggccag
ccgacaatattctaccgcgactacgaggagtggtcaacaagataagctcaagaacctcatctggatacatgacaacctcgccggaggaag
caccgacatagctactacgataacgatgaactcatctcgtcaggaacgggtacggggacaagccggggcttataacctacatcaacctagggc
tcgagcaaggccggaaggtgggtctacgttccgaagttcggggagcgtgcatccacgagtagaccggcaacctcgccggctgggtggaca
agtgggtggactcaagcgggtgggtgtacctcgaggccctgccacgaccggccaacggctattacggctactccgtctggagctactgc
gggtgggctga

SEQ ID NO.: 62

Met Ala Lys Tyr Ser Glu Leu Lys Lys Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Ser
Gly Gly Ile Trp Trp Asp Thr Ile Arg Gln Lys Ile Pro Glu Trp Tyr Glu Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Tyr Phe Asp
Leu Gly Glu Tyr Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Ile Asn Met
Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp
Leu Glu Trp Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr
Thr Ala Asn Tyr Leu Asn Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly Tyr
Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala Ala
Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp Val Val
Lys Asp Trp Leu Asp Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala
Leu Leu Asn Trp Ala Tyr Ser Ser Asp Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Glu
Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn
Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr
Tyr Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Asp Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Gly Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala His Asp Pro Ala Asn Gly Tyr Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 63

atggccaagtactccgagctgaaagagggcgggggtcataatgcaggcgttctactgggacgtgccttcaggaggaatatgggtgggacacaat
acggcagaagataccggagtggtacgatgccggaatctccgcaatatgattccccggcgagcaagggtatggcggcgccctattcgatg
ggctacgaccctacgacttctttgacctcggtagtactaccagaagggaacggtagagacgcgtttggctccaagcaggagctcgtgaa
catgataaacacggcccatgcctacggcataaaggccatagcggacatcgtcataaaccaccgcgcaggcggagacctcgagtggaaacctg

Figure 16W

tctgttggggactacacctggacggacttctcaaaggtggcctcgggcaaataactgccaactacctcgacttccaccccaacgagggtcaagt
gctgtgacgagggcacatttgaggcttcccagacatagcccacgagaagagctgggaccagcactggctctgggcgagcgatgagagcta
cgccgectacctaaggagcatcggcggtgatgcctggcgctttgactacgtgaagggtctacggagcgtgggtcgtcaaggactggctcaactg
gtggggcggtggggcggtggcgagtactgggacaccaacgttgatgcactcctaactgggcctactcagcggcgccaaggctcttcgactt
cccgtctactacaagatggacgcggcctttgacaacaagaacattcccgcactcgtcagggccctcaagaacgggggcacagtcgtcagcc
gcgacccgttaaggccgtaaccttctgttcaaaccacgacaccgataatctggaacaagtatccagcctacgcgttcactcctacacacgag
ggccagccgacaatatctaccgcgactacgaggagtggctcaacaaggataagctcaagaacctcatctggatacatgacaacctcgccgg
aggaagcaccgacatagtctactacgataacgatgaactcatcttctcaggaacggctacggggacaagccggggcttataacctacatcaa
cctaggctggagcaaggccggaagggtgggtttatgtgccgaagttcggggcggtgcatccacgagatatactggtaacctcgagggtggg
tagacaagtacgtctactcaagcggtgggtctatctcgaagctccagcttacgacctgccaacgggcagtatggctactccgtgtggagcta
ctcggggggtgggggtga

SEQ ID NO.: 64

Met Ala Lys Tyr Leu Glu Leu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Ser
Gly Gly Ile Trp Trp Asp Thr Ile Arg Gln Lys Ile Pro Glu Trp Tyr Asp Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp
Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val Asn
Met Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Ala Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly
Asp Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys
Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Val Lys Cys Cys Asp Glu Gly Thr Phe Gly
Gly Phe Pro Asp Ile Ala His Glu Lys Ser Trp Asp Gln His Trp Leu Trp Ala Ser Asp Glu Ser Tyr
Ala Ala Tyr Leu Arg Ser Ile Gly Val Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp
Val Val Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp
Ala Leu Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp
Ala Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Glu Ala Leu Lys Asn Gly Gly Thr Val Val Ser
Arg Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro
Ala Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu
Asn Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Asp Ile Val
Tyr Tyr Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Asp Lys Pro Gly Leu Ile Thr Tyr
Ile Asn Leu Gly Trp Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His
Glu Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Tyr Val Tyr Ser Ser Gly Trp Val Tyr Leu Glu
Ala Pro Ala Tyr Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 65

atggccaagtactccgagctggaagaaggcggcggttataatgcaggccttctactgggacgtcccaggtggaggaatctggtggggcaccat
caggagcaagataccggagtggtacgagggcggaatatccgccatttgattcctcccgcgagcaagggtatgagcggcggtattcgatgg
gctacgaccctacgattatttgacctcgggtgagtactaccagaagggaacgggtggaacgaggttcggctcaaagcaggagctcataaacat
gataaacaccgcccacgcctatggcatgaaggtaatagccgatatagtcatcaaccaccgcgccggcggtgacctggagtgaaccccttctg
gaacgactatactggaccgacttctcaaaggctcgcgtcgggtaatacacggccaactacctcgacttccacccgaacgagctccatcgggg
cgattccggaacatttgagggtatcccagacatatgccacgacaagagctgggaccagtagtggctctgggcccagcaggagctacgcgg
catatctcaggagcatcggcatcgatgcctggcgctcactacgtcaagggtatgctccctgggtcgtcaaggactggctgaactggtgggg
aggctgggcgggtggagagtactgggacaccaacgtcgacgctgttctcaactgggcatactcagcgggtccaaggtctttgacttcgccctc
tactacaagatggacgaggccttcgataacaacaacattcccgcctgggtggacgccctcagatacggtcagacagtggtcagccgcgaccc
gttcaaggctgtgacgtttgtagccaaccacgataccgatataatttgaacaagtaccggcctacgccttcactcctacacgaggccagc
cgacgatattctaccgcgactacgaggagtggctcaacaaggacggctcaagaacctcatctggatacacgaccacctcgccggtggaagc
acgagcatagttactacgacagcgacgagatgatctctgtgaggaacggctatggaagcaagcctggccttataacttacatcaacctcggctc
gagcaagggttgaaggtgggtttacgttccgaagttcgcaggctcgtgcatacacgagtagaccggcaatctcggcggttggtggacaagt
gggtggactcaagcggttggtctacctcgaggctcctgcccacgacccggccaacggccagtagcgtactccgtctggagctattgctggt
gttggtcga

Figure 16X



SEQ ID NO.: 66

Met Ala Lys Tyr Ser Glu Leu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Gly
Gly Gly Ile Trp Trp Gly Thr Ile Arg Ser Lys Ile Pro Glu Trp Tyr Glu Ala Gly Ile Ser Ala Ile Trp Ile
Pro Pro Ala Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Tyr Phe Asp Leu
Gly Glu Tyr Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Ile Asn Met Ile
Asn Thr Ala His Ala Tyr Gly Met Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp
Leu Glu Trp Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr
Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly Tyr
Pro Asp Ile Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala Ala
Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Ala Pro Trp Val Val
Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala Val
Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Ala Leu Tyr Tyr Lys Met Asp Glu Ala
Phe Asp Asn Asn Asn Ile Pro Ala Leu Val Asp Ala Leu Arg Tyr Gly Gln Thr Val Val Ser Arg Asp
Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala Tyr
Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn Lys
Asp Arg Leu Lys Asn Leu Ile Trp Ile His Asp His Leu Ala Gly Gly Ser Thr Ser Ile Val Tyr Tyr
Asp Ser Asp Glu Met Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile Asn
Leu Gly Ser Ser Lys Val Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His Glu Tyr
Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu Ala Pro
Ala His Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 67

atggccaagtacctggagctcgaagagggcggtgcataatgcaggcgttctactgggacgtgccttcgggaggaatatggtgggacacaat
acggcagaagataccggagtggtacgatccggaatctccgcaatatggattcctcccgcgagcaagggtatgagcggcggtattcgaatg
gctacgacctacgattattttgacctcgtgagtactaccagaagggaacgggtgaaacgaggttcggctcaaaagcaggagctcataaacat
gataaacacggcccatgcctacggcataaaggatcatagcggacatcgtcataaaccaccgcgcaggcggagacctcgagtgaaccggtc
gttggggactacacctggacggacttctcaaaagggtggcctcgggcaaatatactgccaactacctcgacttccacccaacgaggtcaagtgt
gtgacgagggcacatttgagggttccagacatagcccacgagaagagctgggaccagcactggctctgggcgagcgatgagagctacg
ccgctacctaaggagcatcggttgatgcctggcgcttcgactacgtcaagggtacggagcgtgggtcgtcaaggactggctggactggt
ggggagggtgggcccgtcggggagtactgggacacaaacgttgatgcactgctcaactgggctactcgagcgatgcaaaagtcttgacttc
ccgctctactacaagatggacgagggccttcgataacaacaacattcccgccttggtggacgccctcagatacgggtcagacagtggtcagccgc
gacctgtcaaggctgtgacgtttgtagccaaccacgataccgatataatctggaacaagtatccagcctacgcgttcacctcacctacgaggg
ccagccgacaatattctaccgcgactacgaggagtggctcaacaaggataagctcaagaacctcatctggatacatgacaacctcggcgag
gaagcacgagcatagtactacgacagcgacgagatgatcttcgtgaggaacggctatggaagcaagcctggccttataacttacatcaacct
cggctcgagcaaggttggaaggtgggtctacgttcgaagttcggggagcgtgcattccacgagtacaccggcaacctcggcggtgggtg
gacaagtgggtggactcaagcgggtgggtgtacctcgaggccccctgccacgaccggccaacggctattacggctactccgtctggagcta
ctgcgtggtgggtga

SEQ ID NO.: 68

Met Ala Lys Tyr Leu Glu Leu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Ser
Gly Gly Ile Trp Trp Asp Thr Ile Arg Gln Lys Ile Pro Glu Trp Tyr Asp Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Tyr Phe Asp
Leu Gly Glu Tyr Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Ile Asn Met
Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp
Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr
Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Val Lys Cys Cys Asp Glu Gly Thr Phe Gly Gly
Phe Pro Asp Ile Ala His Glu Lys Ser Trp Asp Gln His Trp Leu Trp Ala Ser Asp Glu Ser Tyr Ala
Ala Tyr Leu Arg Ser Ile Gly Val Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp Val
Val Lys Asp Trp Leu Asp Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala
Leu Leu Asn Trp Ala Tyr Ser Ser Asp Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Glu

Figure 16Y



Ala Phe Asp Asn Asn Asn Ile Pro Ala Leu Val Asp Ala Leu Arg Tyr Gly Gln Thr Val Val Ser Arg
Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala
Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn
Lys Asp Lys Leu Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Ser Ile Val Tyr
Tyr Asp Ser Asp Glu Met Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile
Asn Leu Gly Ser Ser Lys Val Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu Ala
Pro Ala His Asp Pro Ala Asn Gly Tyr Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Val Val Gly

SEQ ID NO.: 73

atggctctggaagagggcggttataatgcaggccttctactgggacgtccaggtggaggaatctggtgggacaccatagcccagaagat
acccgactgggcgagcgccgggatttcggcaatatggattcctccgcgagtaagggcatgagcggcggtctattcgatgggctacgacctt
acgatttctcgacctgggtgagtactaccagaagggaagcggtgagaccgcttcggatcaaaagaggagcttgtaacatgataaacaccgc
ccatgctcacaacatgaaggtcatagcggacatagtcataaccaccgcgcggcgccgacctggagtggaaatcctttaccaacagctacac
ctggaccgatttctgaaggtcgcgtcgggcaagtacacggccaactacctgacttccaccgaacgagcttcacgcgggcgattccggaa
catttggaggctatcccacatatgccacgacaagagctgggaccagcactggctctggccagcaacgaaagctacgccgcctacctccgg
agcatcggtcatcgacctggcgcttcgactacgtcaagggtactgctccctgggtcgttaagaactggctgaaccgggtggggcggtgggc
ggttggagagtactgggacaccaacgtcgtgactcctgagctgggctacgacacgggtgctaaagtcttcgacttcccgtctactacaag
atggacgaggccttcgataacaacaacatccccgcctcgtggagcgcctcaagaacggagggcacggctgcagccgcgacccgttcaaag
ccgtgaccttcgttccaaccacgataccaacataatctggaacaagtatccggcctacgccttcctcctacatagaggacagccggcaat
attctaccgcgactacgaggagtggctcaacaaggacaggtcaggaacctcatctggatacacgaccacctcgcgggaggaagcacagac
atcatctactacgacacgacgagcttatctcgtgagaacgggtacggggacaagccgggactgataacctacatcaacctcgggtcaagc
aaggccggaaggtgggtctacgttcgaaggtcgcaggtcgtgcatacacgagtagaccggcaacctcggcggttgattgacaagtgggt
tgactcaagcgggtcgggtctacctgaggcccccgccacgaccggccaacggccagtagcggtactcctgatggagctactcggtgttg
ggtga

SEQ ID NO.: 74

Met Ala Leu Glu Glu Gly Gly Leu Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Gly Gly Gly Ile Trp
Trp Asp Thr Ile Ala Gln Lys Ile Pro Asp Trp Ala Ser Ala Gly Ile Ser Ala Ile Trp Ile Pro Pro Ala
Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp Leu Gly Glu Tyr
Tyr Gln Lys Gly Ser Val Glu Thr Arg Phe Gly Ser Lys Glu Glu Leu Val Asn Met Ile Asn Thr Ala
His Ala His Asn Met Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp Leu Glu Trp
Asn Pro Phe Thr Asn Ser Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr Thr Ala Asn
Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly Tyr Pro Asp Ile
Cys His Asp Lys Ser Trp Asp Gln His Trp Leu Trp Ala Ser Asn Glu Ser Tyr Ala Ala Tyr Leu Arg
Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Ala Pro Trp Val Val Lys Asn Trp
Leu Asn Arg Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala Leu Leu Ser Trp
Ala Tyr Asp Ser Gly Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Glu Ala Phe Asp
Asn Asn Asn Ile Pro Ala Leu Val Asp Ala Leu Lys Asn Gly Gly Thr Val Val Ser Arg Asp Pro Phe
Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asn Ile Ile Trp Asn Lys Tyr Pro Ala Tyr Ala Phe Ile
Leu Thr Tyr Glu Gly Gln Pro Ala Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn Lys Asp Arg Leu
Arg Asn Leu Ile Trp Ile His Asp His Leu Ala Gly Gly Ser Thr Asp Ile Ile Tyr Tyr Asp Ser Asp Glu
Leu Ile Phe Val Arg Asn Gly Tyr Gly Asp Lys Pro Gly Leu Ile Thr Tyr Ile Asn Leu Gly Ser Ser
Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His Glu Tyr Thr Gly Asn Leu
Gly Gly Trp Ile Asp Lys Trp Val Asp Ser Ser Gly Arg Val Tyr Leu Glu Ala Pro Ala His Asp Pro
Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 75

atggctctggaagagggcggttataatgcaggcattctactgggacgtcccatgggaggaatctggtgggacacgatagcccagaagat
acccgactgggcaagcgccgggatttcggcatatggattcccccgagcaaggggtatgagcggcggtctattcgatgggctacgacctt

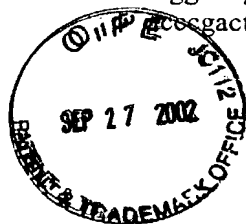


Figure 16Z

acgattattttgacctcgggtga gtactaccagaagggaacgggtgaaacaagattcggctcaaagcaggagctcataaacatgataaacaccg
cccacgcctatggcatgaaggtaatagccgatatagtcatcaaccaccgcgccggcgatctggagtgaaccccttcgtgaacgactata
cctggaccgacttctcgaaggctcgcgtcgggtaaatacacggccaactacctcgacttccacccgaacgagctccacgcgggcgattccgga
acatttggaggctatcccgacatatgccacgacaagagctgggaccagtactggctctgggccagccaggagagctacgcggcctatctcag
gagcatcggcatcgacgcctggcgcttcgactacgtcaagggtatgctccctgggtcgtcaggagctggctgaactggtggggaggctggg
cagttggagagtactgggacaccaacgtcgacgctgttctcaactgggcatactcgagcgggtgccaaggctttgacttcgcccttactacaag
atggacgaggccttcgataacaacaacattcccgccctgggtggacgccctcagatacggccagacagtggtcagccgcgacccgttcaaggc
tgtgacgtttgtagccaaccacgataccgacataatctggaacaagtatccagcctacgcgttcacctcacctacgagggccagccgacaat
tctaccgcgactacgaggagtggctcaacaaggacaagctcaagaacctcatctggatacatgacaacctcgccggaggggagcactgacatc
gtttactacgacaacgacgagctgatattcgtgaaaacggctacggaagcaagccgggactgataacatacatcaacctcggtcgaagcaa
gccggaaggtgggtttacgttccgaagttcgcaggctcgtgcatacacgagtacaccggcaacctcgccggctgggtgggacaagtgggtgga
ctcaagcggctgggtttacctcgaggctcctgccacgaccggccaacggccagtagcggctactccgtttggagctattgcggtgttgggtga

SEQ ID NO.: 76

Met Ala Leu Glu Glu Gly Gly Leu Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Met Gly Gly Ile Trp
Trp Asp Thr Ile Ala Gln Lys Ile Pro Asp Trp Ala Ser Ala Gly Ile Ser Ala Ile Trp Ile Pro Pro Ala
Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Tyr Phe Asp Leu Gly Glu Tyr
Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Ile Asn Met Ile Asn Thr Ala
His Ala Tyr Gly Met Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp Leu Glu Trp
Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr Thr Ala Asn
Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly Tyr Pro Asp Ile
Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala Ala Tyr Leu Arg
Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Ala Pro Trp Val Val Arg Asp Trp
Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala Val Leu Asn Trp
Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Ala Leu Tyr Tyr Lys Met Asp Glu Ala Phe Asp Asn
Asn Asn Ile Pro Ala Leu Val Asp Ala Leu Arg Tyr Gly Gln Thr Val Val Ser Arg Asp Pro Phe Lys
Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala Tyr Ala Phe Ile
Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn Lys Asp Lys Leu
Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr Tyr Asp Asn Asp
Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile Asn Leu Gly Ser Ser
Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His Glu Tyr Thr Gly Asn Leu
Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu Ala Pro Ala His Asp Pro
Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 77

atggctctggaagagggcgggctcataatgcaggccttctactgggacgtcccatgggaggaatctggtgggacacgatagccagaagat
accgactgggcaagcgccgggatttcggcgatatggatccctcccgagcaagggtatgagcggcgctattcgatgggctacgacctt
acgattattttgacctcgggtgagtactaccagaagggaacgggtgaaacgaggttcggctcaaagcaggagctcataaacatgataaacaccg
cccacgcctatggcatgaaggtaatagccgatatagtcatcaaccaccgcgccggcggtgacctggagtgaaccccttcgtgaacgactata
cctggaccgacttctcaaaggtcgcgtcgggtaaatacacggccaactacctcgacttccacccgaacgagctccatgcgggcgattccggaa
catttggaggctatcccgacatatgccacgacaagagctgggaccagtactggctctgggccagccaggagagctacgcggcctatctcagg
agcatcggcatcgatgcctggcgcttcgactacgtcaagggtatgctccctgggtcgtcaaggactggctgaactggtggggaggctgggc
gggtggagagtactgggacaccaacgtcgacgctgttctcaactgggcatactcgagcgggtgccaaggctttgacttcgcccttactacaaga
tggacgaggccttcgataacaacaacattcccgccctgggtggacgccctcagatacggtcagacagtggtcagccgcgacccgttcaaggct
gtgacgtttgtagccaaccacgataccgacataatctggaacaagtatccagcctacgcgttcacctcacctacgagggccagccgacaatatt
ctaccgcgactacgaggagtgggtcaacaaggataagctcaagaacctcatctggatacatgacaacctcgccggaggggagcactgacatcg
tttactacgacaacgacgagctgatattcgtgaaaacggctacggaagcaagccgggactgataacatacatcaacctcgctcaagcaaag
ccggaaggtgggtttacgttccgaagttcgcaggctcgtgcatacacgagtacaccggcaatctcgccggctgggtgggacaagtgggtggac
tcaagcggctgggttacctcgaggctcctgccacgaccggccaacggccagtagcggctactccgtctggagctactcggtgttgggtga

Figure 16AA



SEQ ID NO.: 78

Met Ala Leu Glu Glu Gly Gly Leu Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Met Gly Gly Ile Trp
Trp Asp Thr Ile Ala Gln Lys Ile Pro Asp Trp Ala Ser Ala Gly Ile Ser Ala Ile Trp Ile Pro Pro Ala
Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Tyr Phe Asp Leu Gly Glu Tyr
Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Ile Asn Met Ile Asn Thr Ala
His Ala Tyr Gly Met Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp Leu Glu Trp
Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr Thr Ala Asn
Tyr Leu Asp Phe His Pro Asn Glu Leu His Ala Gly Asp Ser Gly Thr Phe Gly Gly Tyr Pro Asp Ile
Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Gln Glu Ser Tyr Ala Ala Tyr Leu Arg
Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Ala Pro Trp Val Val Lys Asp Trp
Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala Val Leu Asn Trp
Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Ala Leu Tyr Tyr Lys Met Asp Glu Ala Phe Asp Asn
Asn Asn Ile Pro Ala Leu Val Asp Ala Leu Arg Tyr Gly Gln Thr Val Val Ser Arg Asp Pro Phe Lys
Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala Tyr Ala Phe Ile
Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn Lys Asp Lys Leu
Lys Asn Leu Ile Trp Ile His Asp Asn Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr Tyr Asp Asn Asp
Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile Asn Leu Ala Ser Ser
Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His Glu Tyr Thr Gly Asn Leu
Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu Glu Ala Pro Ala His Asp Pro
Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 79

atgaagcctgcgaactcctcgtctttgtgctcgtagctctatcctcgcggggctctacgcccagcccgcgggggcccgaagtacctggagc
tcgaagagggcggcgctcataatgcaggcgttctactgggacgtgccttcaggagggaatatgggtgggacacaatacggcagaagataccgga
gtggtacgatgccgaatcccgcaatatggattccccggcgagcaagggcatggcgccgctattcgatgggctacgacccctacgactt
ctttgacctcggtagtacgaccagaagggaacggtagagacgcgtttggctccaagcaggagctcgtgaacatgataaacaccgcccacg
cctacggcatcaaggatcgcagacatagtaatcaaccaccgcgcggaggagaccttgagtgaaccccttcgtaatgactacacctgga
cggacttctcgaaggtcgttccggcaagtacacggccaactacctcgaacttcaccccaacgaggtcaagtctcgcacgagggcacctttg
gagggttcccgacatagccacgagaagagctgggaccagtactggctctgggcgagcaacgagagctacgccgctacctcaggagca
tcggcgttgacgatggcgttcgactacgtcaagggctacggagcgtgggtcgtcaaggactggctggactgggtgggaggctgggccgt
cggggagtactgggacacaaacgttgatgcactgtcaactgggctactcgagcgatgcaaaagtcttcgacttcccgctactacaagatg
gacgggcctttgacaacaagaacattcccgcactcgtcaggccctcaagaacgggggcacagtcgtcagccgcgacccgttaaggccgt
aaccttcgttgcaaacacgacacggacataatttgaacaagtaccggccctacgccttcacctacaggggccagccgacgatattc
taccgcgactacgaggagtggctcaacaaggacaggctcaagaacctcatctggatacacgaccacctcgcgggtggaagcaccgacatag
tctactacgataacgatgaactcatcttcgaggaacggctacggggacaagccggggcttataacctacatcaacctaggctcgagcaagg
ccgggaggtgggtctacgttccgaagttcgcgggagcgtgcattccacgagtacaccggcaacctcggcggtgggtgggacaaagtgggtgga
ctcaagcgggigggtgtacctcaggccctgccacgacccggccaacggctattacggctactccgtctggagctactcgggggtgggtg
ga

SEQ ID NO.: 80

Met Lys Pro Ala Lys Leu Leu Val Phe Val Leu Val Val Ser Ile Leu Ala Gly Leu Tyr Ala Gln Pro
Ala Gly Ala Ala Lys Tyr Leu Glu Leu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val
Pro Ser Gly Gly Ile Trp Trp Asp Thr Ile Arg Gln Lys Ile Pro Glu Trp Tyr Asp Ala Gly Ile Ser Ala
Ile Trp Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe
Phe Asp Leu Gly Glu Tyr Asp Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Val
Asn Met Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly
Gly Asp Leu Glu Trp Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly
Lys Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Val Lys Cys Cys Asp Glu Gly Thr Phe
Gly Gly Phe Pro Asp Ile Ala His Glu Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Asn Glu Ser
Tyr Ala Ala Tyr Leu Arg Ser Ile Gly Val Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala

Figure 16BB



Trp Val Val Lys Asp Trp Leu Asp Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val
Asp Ala Leu Leu Asn Trp Ala Tyr Ser Ser Asp Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met
Asp Ala Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Glu Ala Leu Lys Asn Gly Gly Thr Val Val
Ser Arg Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr
Pro Ala Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Thr Ile Phe Tyr Arg Asp Tyr Glu Glu Trp
Leu Asn Lys Asp Arg Leu Lys Asn Leu Ile Trp Ile His Asp His Leu Ala Gly Gly Ser Thr Asp Ile
Val Tyr Tyr Asp Asn Asp Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Asp Lys Pro Gly Leu Ile Thr
Tyr Ile Asn Leu Gly Ser Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile
His Glu Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Trp Val Asp Ser Ser Gly Trp Val Tyr Leu
Glu Ala Pro Ala His Asp Pro Ala Asn Gly Tyr Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 81

atgaagaagttgtgcgacctgttcataaccatgttttcgtagtgagcatggcagtcgttgacagccagctagcggcgcaaagtattccgagctc
gaagaaggcggcggttataatgcaggccttctactgggacgtcccaggtggaggaaatctggtgggacaccatcaggagcaagataccggagt
ggtacgaggcgggaatatccgccatttggattccgccagccagcaaggggatgagcggcggttactcgtatgggtacgatccctacgatttctt
tgacctcggcgagtagacaaccagaagggaaccatcgaaacgcgtttggctctaacaaggagctcatcaatatgataaacacggcccatgccta
cggcataaaggtagatagcggacatcgtcataaaccacgcgcaggcggagacctcgagtgaaccggttcgttggggactacacctggacg
gacttctcaagggtggcctcgggcaaatatactgccaaactacctcgaactccacccaacgaggtcaagtgtgtgacgagggcacatttggag
gttcccagacatagccacgagaagagctgggaccagcactggctctgggcgagcgatgagagctacggcgctacctaaggagcatcg
gcgttgatgcctggcgcttggactacgtgaagggtctacggagcgtgggtcgtaaggactggctcaactgggtggggcggtcggccgttggc
gagtactgggacaccaacgttgatgcactcctcaactgggcctactcgagcggcgccaaggtcttcgacttcccgtctactacaagatggatg
aggcctttgacaacaaaacattccagcgctcgtctctgcccctcagaacggccagactgttctcctccgcgacccgttcaaggccgtaaccttt
gtagcaaacacgacacgatataatctggaacaagtacgttcttctcctcctacacgaaggccagcccgctatattctaccgcgac
tacgaggagtggtcaacaaggacaggtgaacaacctcatatggatacacgaccacctcgaggtggaagcacgagcatagctactacga
cagcgacgagatgatcttctgtaggaacggctatggaagcaagcctggccttataactacatcaacctcggtcgagcaaggttgaagggtg
ggtttatgtgccgaagttcgggcgcggtgcacccagagtatactggtaacctcgaggctgggtagacaagtacgtctactcaagcggctg
ggtctatctcgaagctccagcttacgacctgccaacgggcagtatggctactccgtgtggagctattgcgggtgtgggtga

SEQ ID NO.: 82

Met Lys Lys Phe Val Ala Leu Phe Ile Thr Met Phe Phe Val Val Ser Met Ala Val Val Ala Gln Pro
Ala Ser Ala Ala Lys Tyr Ser Glu Leu Glu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val
Pro Gly Gly Gly Ile Trp Trp Asp Thr Ile Arg Ser Lys Ile Pro Glu Trp Tyr Glu Ala Gly Ile Ser Ala
Ile Trp Ile Pro Pro Ala Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe
Phe Asp Leu Gly Glu Tyr Asn Gln Lys Gly Thr Ile Glu Thr Arg Phe Gly Ser Lys Gln Glu Leu Ile
Asn Met Ile Asn Thr Ala His Ala Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly
Gly Asp Leu Glu Trp Asn Pro Phe Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly
Lys Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Val Lys Cys Cys Asp Glu Gly Thr Phe
Gly Gly Phe Pro Asp Ile Ala His Glu Lys Ser Trp Asp Gln His Trp Leu Trp Ala Ser Asp Glu Ser
Tyr Ala Ala Tyr Leu Arg Ser Ile Gly Val Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala
Trp Val Val Lys Asp Trp Leu Asn Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val
Asp Ala Leu Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met
Asp Glu Ala Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Ser Ala Leu Gln Asn Gly Gln Thr Val Val
Ser Arg Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr
Leu Ala Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Val Ile Phe Tyr Arg Asp Tyr Glu Glu Trp
Leu Asn Lys Asp Arg Leu Asn Asn Leu Ile Trp Ile His Asp His Leu Ala Gly Gly Ser Thr Ser Ile
Val Tyr Tyr Asp Ser Asp Glu Met Ile Phe Val Arg Asn Gly Tyr Gly Ser Lys Pro Gly Leu Ile Thr
Tyr Ile Asn Leu Gly Ser Ser Lys Val Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ala Cys Ile
His Glu Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Lys Tyr Val Tyr Ser Ser Gly Trp Val Tyr Leu
Glu Ala Pro Ala Tyr Asp Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly



Figure 16CC

SEQ ID NO.: 83

atggctctggaagacggcgggctcataatgcaggccttctactgggatgttctctggaggaggaatctggtgggacacaatagctcaaaagata
cccgaatgggcaagtgcaggaatctcagcgatatggattccaccagcgagtaagggcatgagcgggtgttattccatgggctacgatccctac
gatttcttgacctcggcgagtactatcagaaggggacagttgagacgcgcttcggctcaaagggaagaactggtgaacatgataaacaccgca
cactcctacggcataaaggtgatagcagacatagtcataaaccaccgcgcgggtggagaccttgagtgaacccctcgtgaacgactataacct
ggacagacttctcaaaagtcgcctccggttaaataatagcgccaactaccttgacttccacccaacgagcttctactgttgatgaaggtaccttg
gaggataccctgatataatgtcacgacaaaagctgggaccagtactggctctgggcgagcagcgaaagctacgctgcctacctcaggagcata
ggggttgacgcctggcggttcgactacgtcaagggctacggagcatgggttgtaacgactggctcagctggtggggaggctgggcccgttga
gagtactgggacacgaacgttgatgcactcctcaactgggcatacagcagcgccgccaaggtcttgacttcccgtctactacaagatggacg
aagccttcgacaacaccaacatcccggcattagtgatgcactagatacggccagacagtggtcagccgcgatccctcaaggcggtaacttt
cgttgccaaccacgatacagataatctggaacaagtatccggcttatgcattcatccttacctatgagggacagcctgttatattctaccgcgac
tacgaggagtggctcaacaagataagcttaacaacctcatctggatacacgatcaccttgctggaggaggagtactgacattgtttactacgacg
cgacgagcttatcttgtgagaaacggctatggcaccacacaggactgataacctatatcaacctcggctcaagcaaagtggaggtgggtc
tacgttccaaagttcgccggttcgatgccacgagtacaccggcaacctcggcggttgatagacaagtagctctcctccagcggtgggtct
atcttgaggccccagccccagaccggcggaacggctactacggctactccgtatggagctactcgggggttgggtga

SEQ ID NO.: 84

Met Ala Leu Glu Asp Gly Gly Leu Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Gly Gly Gly Ile Trp
Trp Asp Thr Ile Ala Gln Lys Ile Pro Glu Trp Ala Ser Ala Gly Ile Ser Ala Ile Trp Ile Pro Pro Ala
Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp Leu Gly Glu Tyr
Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Glu Glu Leu Val Asn Met Ile Asn Thr Ala
His Ser Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp Leu Glu Trp Asn
Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr Thr Ala Asn Tyr
Leu Asp Phe His Pro Asn Glu Leu His Cys Cys Asp Glu Gly Thr Phe Gly Gly Tyr Pro Asp Ile Cys
His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Ser Glu Ser Tyr Ala Ala Tyr Leu Arg Ser
Ile Gly Val Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp Val Val Asn Asp Trp Leu
Ser Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala Leu Leu Asn Trp Ala
Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Glu Ala Phe Asp Asn Thr
Asn Ile Pro Ala Leu Val Asp Ala Leu Arg Tyr Gly Gln Thr Val Val Ser Arg Asp Pro Phe Lys Ala
Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala Tyr Ala Phe Ile Leu
Thr Tyr Glu Gly Gln Pro Val Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn Lys Asp Lys Leu Asn
Asn Leu Ile Trp Ile His Asp His Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr Tyr Asp Ser Asp Glu
Leu Ile Phe Val Arg Asn Gly Tyr Gly Thr Lys Pro Gly Leu Ile Thr Tyr Ile Asn Leu Gly Ser Ser
Lys Val Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His Glu Tyr Thr Gly Asn Leu
Gly Gly Trp Ile Asp Lys Tyr Val Ser Ser Ser Gly Trp Val Tyr Leu Glu Ala Pro Ala His Asp Pro
Ala Asn Gly Tyr Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO.: 85

atggctctggaagagggcgggcttataatgcaggcattctattgggacgtccaggtggaggaatctggtgggacaccatagcccagaagata
cccgaatgggcaagtgcaggaatctcagcgatatggattccaccagcgagtaaggggaatgagcgggtgttattccatgggctacgatccctac
gatttcttgacctcggcgagtactatcagaaggggacagttgagacgcgcttcggctcaaagggaagaactggtgaacatgataaacaccgca
cactcctacggcataaaggtgatagcggacatagtcataaaccaccgcgcgggtggagggcctcagtggaacccctcgtgaacgactataacc
tggacagacttctcaaaagtcgcctccggttaaataatagcgccaactaccttgacttccacccaacgagcttctactgttgatgaaggtaccttg
gaggataccctgatataatgtcacgacaaaagctgggaccagtactggctctgggcgagcagcgaaagctacgctgcctacctcaggagcata
ggggttgacgcctgggtgttcgactacgtcaagggctacggagcctgggttgtaacgactggctcagctggtggggaggctgggcccgttga
gagtactgggacactaacgttgatgcactcctcaactgggcatacaacagcgccgccaaggtcttgacttcccgtctactacaagatggacg
aagccttcgacaataccaacatccccgcttgggttacgccctcaagaatggcgggacagtggtcagccgcgacccattcaaggcggtaacttt
cgttgccaaccacgatacagataatctggaacaagtatccggcttatgcattcatccttacctatgagggacagcctgttatattctaccgcgac
tacgaggagtggctcaacaaggataagcttaacaacctcatctggatacacgatcaccttgctggaggaggagtactgacattgtttactacgacg
cgacgagcttatcttgtgagaaacggctatggcaccacacaggactgataacctatatcaacctcggctcaagcaaagctggaaggtgggtc



Figure 16DD

Applicant(s): Walter Callen et al.
ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

tacgttccaaagtgcgccggttcacatccacaggtacaccggcagcctcggcggttgatagacaagtacgtctctccagcggctgggtct
accttgaggccccggccacgacccggccaatggccagtatggctactccgtctggagctattgcggggttggtga

SEQ ID NO.: 86

Met Ala Leu Glu Gly Gly Leu Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Gly Gly Gly Ile Trp
Trp Asp Thr Ile Ala Gln Lys Ile Pro Glu Trp Ala Ser Ala Gly Ile Ser Ala Ile Trp Ile Pro Pro Ala
Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp Leu Gly Glu Tyr
Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Glu Glu Leu Val Asn Met Ile Asn Thr Ala
His Ser Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Gly Leu Glu Trp Asn
Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr Thr Ala Asn Tyr
Leu Asp Phe His Pro Asn Glu Leu His Cys Cys Asp Glu Gly Thr Phe Gly Gly Tyr Pro Asp Ile Cys
His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Ser Glu Ser Tyr Ala Ala Tyr Leu Arg Ser
Ile Gly Val Asp Ala Trp Cys Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp Val Val Asn Asp Trp Leu
Ser Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala Leu Leu Asn Trp Ala
Tyr Asn Ser Gly Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Glu Ala Phe Asp Asn
Thr Asn Ile Pro Ala Leu Val Tyr Ala Leu Lys Asn Gly Gly Thr Val Val Ser Arg Asp Pro Phe Lys
Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala Tyr Ala Phe Ile
Leu Thr Tyr Glu Gly Gln Pro Val Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn Lys Asp Lys Leu
Asn Asn Leu Ile Trp Ile His Asp His Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr Tyr Asp Ser Asp
Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Thr Lys Pro Gly Leu Ile Thr Tyr Ile Asn Leu Gly Ser
Ser Lys Ala Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His Glu Tyr Thr Gly Ser
Leu Gly Gly Trp Ile Asp Lys Tyr Val Ser Ser Ser Gly Trp Val Tyr Leu Glu Ala Pro Ala His Asp
Pro Ala Asn Gly Gln Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Gly Val Gly

SEQ ID NO: 87

atgttctgctcgcgttttgcactgcctcgtgttctgccaacaggacagcccgccaaggctgccgcaccgttaacggcaccatgatgca
gtatttgaatggtacttgcggatgatggcacgttatggaccaagtggccaatgaagccaacaacttatccagccttggcatcaccgcttttg
gctgccgcccgttacaaaggaacaagccgcagcgacgttagggtagggatatacgaacttgatgacctcggcgaaattcaatcaaaaaggga
ccgtccgcacaaaatacgaacaaaagctcaatatcttcaagccattcaagccgcccacgccgctggaatgcaagtgtacgccgatgtcgtgtt
cgaccataaaggcggcgctgacggcacggaatgggtggagccgctcgaagtcaatccgtccgaccgcaaccaagaaatctcgggcacctat
caaatccaagcatggacgaaatttgatttccggggcggggcaacacctactccagctttaagtggcgctggtaccattttgacggcggttgattg
gacgaaagccgaaaattgagccgcatttacaattccggcgcatcggaagcgtgggattgggaagtagacacggaaaacggaaactatg
actactaatgtatgccgacctgatgatggatcatccgaagtcgtgaccgagctgaaaaactgggggaaatggtatgcaacacaacgaacatt
gatgggtccggcttgatgccgtaagcatattaagttcagtttttctgattgggtgctgatatgtcgttctcagactggcaagccgctatttaccg
tcggggaatattggagctatgacatcaacaagttgcacaattacattacgaaaacagacggaacgatgtctttgtttgatgccccgttacacaaca
aattttataccgcttccaaatcagggggcgcatgtgatgcgcaggttaatgaccaatactctcatgaaagatcaaccgacattggccgctacctt
cggtgataatcatgacaccgaacccggccaagcgtgcagtcagtggtcgacccatggttcaaacggttgcttacgctttattctaactcggc
aggaaggatacccgctcgtctttatggtgactattatggcattccacaataataattcctcgtgaaaagcaaaatcgatccgctcctcatcgc
gcgagggattatgcttacggaacgaacatgattatcttgatcactccgacatcatcgggtggacaagggaagggtcactgaaaaccagg
atccgggctggccgcactgatcaccgatggcgccgggaggaagcaaatggtgactgttggaacaacacgctggaaggtgtctatga

SEQ ID NO: 88

Met Phe Leu Leu Ala Phe Leu Leu Thr Ala Ser Leu Phe Cys Pro Thr Gly Gln Pro Ala Lys Ala Ala
Ala Pro Phe Asn Gly Thr Met Met Gln Tyr Phe Glu Trp Tyr Leu Pro Asp Asp Gly Thr Leu Trp Thr
Lys Val Ala Asn Glu Ala Asn Asn Leu Ser Ser Leu Gly Ile Thr Ala Leu Trp Leu Pro Pro Ala Tyr
Lys Gly Thr Ser Arg Ser Asp Val Gly Tyr Gly Val Tyr Asp Leu Tyr Asp Leu Gly Glu Phe Asn Gln
Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr Lys Ala Gln Tyr Leu Gln Ala Ile Gln Ala Ala His Ala
Ala Gly Met Gln Val Tyr Ala Asp Val Val Phe Asp His Lys Gly Gly Ala Asp Gly Thr Glu Trp Val
Asp Ala Val Glu Val Asn Pro Ser Asp Arg Asn Gln Glu Ile Ser Gly Thr Tyr Gln Ile Gln Ala Trp
Thr Lys Phe Asp Phe Pro Gly Arg Gly Asn Thr Tyr Ser Ser Phe Lys Trp Arg Trp Tyr His Phe Asp



Figure 16EE

Gly Val Asp Trp Asp Glu Ser Arg Lys Leu Ser Arg Ile Tyr Lys Phe Arg Gly Ile Gly Lys Ala Trp
Asp Trp Glu Val Asp Thr Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Leu Asp Met Asp
His Pro Glu Val Val Thr Glu Leu Lys Asn Trp Gly Lys Trp Tyr Val Asn Thr Thr Asn Ile Asp Gly
Phe Arg Leu Asp Ala Val Lys His Ile Lys Phe Ser Phe Phe Pro Asp Trp Leu Ser Tyr Val Arg Ser
Gln Thr Gly Lys Pro Leu Phe Thr Val Gly Glu Tyr Trp Ser Tyr Asp Ile Asn Lys Leu His Asn Tyr
Ile Thr Lys Thr Asp Gly Thr Met Ser Leu Phe Asp Ala Pro Leu His Asn Lys Phe Tyr Thr Ala Ser
Lys Ser Gly Gly Ala Phe Asp Met Arg Thr Leu Met Thr Asn Thr Leu Met Lys Asp Gln Pro Thr
Leu Ala Val Thr Phe Val Asp Asn His Asp Thr Glu Pro Gly Gln Ala Leu Gln Ser Trp Val Asp Pro
Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu Thr Arg Gln Glu Gly Tyr Pro Cys Val Phe Tyr Gly
Asp Tyr Tyr Gly Ile Pro Gln Tyr Asn Ile Pro Ser Leu Lys Ser Lys Ile Asp Pro Leu Leu Ile Ala Arg
Arg Asp Tyr Ala Tyr Gly Thr Gln His Asp Tyr Leu Asp His Ser Asp Ile Ile Gly Trp Thr Arg Glu
Gly Val Thr Glu Lys Pro Gly Ser Gly Leu Ala Ala Leu Ile Thr Asp Gly Pro Gly Gly Ser Lys Trp
Met Tyr Cys Trp Gln Thr Thr Arg Trp Lys Ser Val Leu

SEQ ID NO: 89

atgaaagaagcgggtgtgtatcaaatctcccgatcgggtctttaatggcaaccctcaaatgataacagcaagcagcaggcacgcggggcgc
agccgattgagcatcgcatgtgctcgatttggcgataatccgcgcctgaaagggacgagcggctacgatggcgacgggtgaatggctgaat
gacttttccggcgagacatcgccggaattgaacaaaagtggattatttgcagtcgcttgagtgagacacgatttacttaatccgatcgcaatg
cgccatcgaaaccataaatatgatgcgagcaattacaagaattggatccgatgttcgggtccccggaagaattccaatcgtttgtcaggcgttg
cgaaccgggggatgcatctcatcttagacggggtgttcaaccacgtatccgacgattcgtattactttgaccgctaccaccgctatccgaccgtc
gggtgcgtatgaatattgggaagcgggtttacgatttgatgaatgaaaaggattgagcaggaagaagcgcggaaacaagtgaagagaagttc
aaacaagaggggacagacgttcagcccgtatgggttcatcttgggtcaatattgaaaacaaaaagtcaatggccattatcaataccaatcatggt
ggggctatgacagctcgccggaggttaagtcgggtgacgggggaaaaagtgccgcatccgagtgaaatgaacaacgatgcgctcgcaattac
atttccgtgaatcggttcggcgaaaagctggattgcccgcctccggctggcggttgatgtggccaatgaggtggatccggcgct
tttggcgagtttcgccaagaattgctcaagggtcgtagcgccgcggtccgacgttaaaagagggggagcagccgctcatttaggggaaa
tttgggatgacgcatcgaaatatttctagggaccagtagcgttgatgaactaccggttccgcggggcggtgctgacttttgaaaacg
gaaatgcagaagaggcggaacaagcgggtgacggccataagggaagactaccaagtgaagcgtttatgcgctgatgaactaatcggttcg
catgacacggcgcgggcggtctttctgcttgggaacggaacggatccgagcgggcgagcgttgatccgaattataatgaggaactggg
aaaaagcggctcaagctggcggtgattttgcagatgggatacccgggagcgccgacgattattacggcgatgaagcgggagtaacaggctc
aaaagaccagacaaccgccgcacgtatccgtggggcaagaatcaaaatctgtgtccattatcagaagtggggcacattcgccagc
accatcaatcgttgttggcccatggcgacatcaagacgggtgtatgcgcaagggtatgtatctatttggcccaatagggcggtgaagcgg
cgctcattgccatcaaccgcggcaatgaggacaagacgggtggcgcttgacgtcgcttctgttccgaacggcaccgtgcttacggatgagtt
gcatgatggcggggaagctacggctgctggcggaacgttgacgggtcacgattccggccctggatggacggatgatgttgggacgggtgacg
gcggaaatgccggcagcagtcagcaattgcaggcgagcgcttcggatggctgcgtgacgttaacgtgggaaggaaatgcatcgagatacc
gaatttacgagtcacgttaaaaggtgccggttatacgtggtgcaagagacggaacaacttcggccacgatcggttcgttgacgaacggaa
cagcctattacttgcggttgcggcggtcgatgaaaacgggaatgaatcaccgaagggtcgaacgaatcgctgcgttcctcattaccgctgac
gagcgacaatgtccagttcgtgacaacgttaagcgatccacactggatttgcaaaagccgcagcaagtggatgtccatgcaacatcgacaat
gtgacaagcaaggagcagctgatgggttgaacgggtgttgcgaagtgaaggcccgatgacgaaacatggaagaatacagagcggctt
accaaggacaagacggcgacgccaacgtgtccgagctgccttcaactccgctcgccgcaggaggtatatactatcgttatgcgctgacgacc
aaccttggcgaggagtgatgtatagagaagcaagtacggttgcggcgagacaacagcgaccaaatagcgccagcagacgccatcg
agctgcggcagcctcggttgaatcgggacaagtgaatttatcatggacgttgttgggaaaaagatggggatgcttatttggtagccatcgag
cgcaacggtgatactgtgcatacaaccattcgatcgccgattcattacagactacgatgtcgaaaacggcaccgagtagacgtatgttgcac
gttgcgtgacggcgccggcaatgttgggtgcaaacacgggtgaacgggtggaacacagggcgctgggagatgtcgcgcaacgggtgc
gggtgacggcgattggcaatttaccgtcgaggtgcagggaagggaacgatcactataagtatgtgaaaggcggtatcgtgggatcaagagg
gggtggccgaccatacgctgaggacgacaacgatgatgacgtgagctactacggctatgggacgattggcaccgacttgaagtacggtc
cacaatgaaggaaacaatacgtatgttgcagacggcatttgcgctggatgatatgccgggtcgtatcgagaggtgcaaaaacaagga
agtcaagtacgatcaaggcgatgccattaaaacgggttttgacgatcaatggcgagcgggtgccgattgatggcggtatggcattctcgt
acacgttgcggcgccgacccatcaaaaagaagtgttgatccatatacgaaccatcgccggaagcaaacagccatttcaaacacgacggcg



Figure 16FF

gagcgattgcgaaaaacacaaaagattacgtgctgaatttagaaacgaagcaattcaaaaagcttctcgagagtacttctagagcgcccgcg
gccccatcgattttccacccgggtgggtaccaggta

SEQ ID NO: 90

Met Lys Glu Ala Val Val Tyr Gln Ile Phe Pro Asp Arg Phe Phe Asn Gly Asn Pro Ser Asn Asp Asn
Ser Lys Gln Gln Ala Arg Gly Ala Gln Pro Ile Glu His Arg Asp Trp Ser Asp Leu Pro Asp Asn Pro
Arg Leu Lys Gly Thr Ser Gly Tyr Asp Gly Asp Gly Glu Trp Ser Asn Asp Phe Phe Gly Gly Asp Ile
Ala Gly Ile Glu Gln Lys Leu Asp Tyr Leu Gln Ser Leu Gly Val Asn Thr Ile Tyr Leu Asn Pro Ile
Ala Asn Ala Pro Ser Asn His Lys Tyr Asp Ala Ser Asn Tyr Lys Glu Leu Asp Pro Met Phe Gly Ser
Pro Glu Glu Phe Gln Ser Phe Val Gln Ala Leu Ala Asn Arg Gly Met His Leu Ile Leu Asp Gly Val
Phe Asn His Val Ser Asp Asp Ser Ile Tyr Phe Asp Arg Tyr His Arg Tyr Pro Thr Val Gly Ala Tyr
Glu Tyr Trp Glu Ala Val Tyr Asp Leu Met Asn Glu Lys Gly Leu Ser Glu Glu Glu Ala Arg Lys Gln
Val Glu Glu Lys Phe Lys Gln Glu Gly Gln Thr Phe Ser Pro Tyr Gly Phe His Leu Trp Phe Asn Ile
Glu Asn Lys Lys Val Asn Gly His Tyr Gln Tyr Gln Ser Trp Trp Gly Tyr Asp Ser Leu Pro Glu Phe
Lys Ser Val Thr Gly Glu Lys Val Pro His Pro Ser Glu Leu Asn Asn Asp Ala Leu Ala Asn Tyr Ile
Phe Arg Glu Ser Asp Ser Val Ala Lys Ser Trp Ile Ala Leu Gly Ala Ser Gly Trp Arg Leu Asp Val
Ala Asn Glu Val Asp Pro Ala Phe Trp Arg Glu Phe Arg Gln Glu Leu Leu Gln Gly Ser Tyr Gly Arg
Gly Pro Thr Leu Lys Glu Gly Glu Gln Pro Leu Ile Leu Gly Glu Ile Trp Asp Asp Ala Ser Lys Tyr
Phe Leu Gly Asp Gln Tyr Asp Ser Val Met Asn Tyr Arg Phe Arg Gly Ala Val Leu Asp Phe Leu
Lys Asn Gly Asn Ala Glu Glu Ala Asp Lys Arg Leu Thr Ala Ile Arg Glu Asp Tyr Pro Ser Glu Ala
Phe Tyr Ala Leu Met Asn Leu Ile Gly Ser His Asp Thr Ala Arg Ala Val Phe Leu Leu Gly Asn Gly
Thr Asp Ser Ser Glu Arg Ala Glu Leu Asp Pro Asn Tyr Asn Glu Glu Leu Gly Lys Lys Arg Leu
Lys Leu Ala Val Ile Leu Gln Met Gly Tyr Pro Gly Ala Pro Thr Ile Tyr Tyr Gly Asp Glu Ala Gly
Val Thr Gly Ser Lys Asp Pro Asp Asn Arg Arg Thr Tyr Pro Trp Gly Lys Glu Asp Gln Asn Leu
Leu Ser His Tyr Gln Lys Val Gly His Ile Arg Gln His His Gln Ser Leu Leu Ala His Gly Asp Ile
Lys Thr Val Tyr Ala Gln Gly Asp Val Tyr Val Phe Ala Arg Gln Tyr Gly Arg Glu Ala Ala Leu Ile
Ala Ile Asn Arg Gly Asn Glu Asp Lys Thr Val Ala Leu Asp Val Ala Ser Leu Leu Pro Asn Gly Thr
Val Leu Thr Asp Glu Leu His Asp Gly Gly Glu Ala Thr Val Ala Gly Gly Thr Leu Thr Val Thr Ile
Pro Ala Leu Asp Gly Arg Met Met Phe Gly Thr Val Thr Ala Glu Met Pro Ala Ala Val Ser Asn Leu
Gln Ala Ser Ala Ser Asp Gly Cys Val Thr Leu Thr Trp Glu Gly Asn Ala Ser Arg Tyr Arg Ile Tyr
Glu Ser Thr Leu Lys Gly Ala Gly Tyr Thr Met Val Gln Glu Thr Glu Thr Thr Ser Ala Thr Ile Gly
Ser Leu Thr Asn Gly Thr Ala Tyr Tyr Phe Ala Val Ala Ala Val Asp Glu Asn Gly Asn Glu Ser Pro
Lys Val Glu Thr Asn Arg Val Val Pro His Tyr Pro Leu Thr Ser Asp Asn Val Gln Phe Val Thr Thr
Leu Ser Asp Ala Thr Leu Asp Leu Ser Lys Pro Gln Gln Val Asp Val His Val Asn Ile Asp Asn Val
Thr Ser Lys Gly Ala Ala Asp Gly Leu Gln Ala Val Leu Gln Val Lys Gly Pro His Asp Glu Thr Trp
Lys Glu Tyr Arg Ala Ala Tyr Gln Gly Gln Asp Gly Asp Ala Asn Val Phe Arg Ala Ala Phe Thr Pro
Leu Ala Ala Gly Thr Tyr Thr Tyr Arg Tyr Ala Leu Thr Thr Asn Leu Gly Glu Glu Trp Met Tyr Thr
Glu Glu Lys Gln Val Thr Phe Ala Ala Asp Asn Ser Asp Gln Ile Ala Pro Ala Asp Ala Ile Glu Leu
Arg Gln Pro Ala Val Glu Ser Gly Gln Val Asn Leu Ser Trp Thr Phe Val Gly Lys Lys Asp Gly Asp
Ala Tyr Leu Leu Ala Ile Glu Arg Asn Gly Asp Ile Val His Thr Thr Thr Ser Ile Gly Asp Ser Phe Thr
Asp Tyr Asp Val Glu Asn Gly Thr Glu Tyr Thr Tyr Val Val Lys Leu Tyr Asp Arg Ala Gly Asn
Val Val Ala Ser Asn Thr Val Lys Val Thr Pro Asp Ile Val Met Val Lys Val Ile Phe Lys Val Arg
Ala Pro Asp Tyr Thr Pro Leu Asp Ala Arg Ile Thr Ile Pro Asn Ser Leu Asn Gly Trp Asn Thr Gly
Ala Trp Glu Met Ser Arg Asn Gly Ala Val Thr Pro Asp Trp Gln Phe Thr Val Glu Val Gln Glu Gly
Glu Thr Ile Thr Tyr Lys Tyr Val Lys Gly Gly Ser Trp Asp Gln Glu Gly Leu Ala Asp His Thr Arg
Glu Asp Asp Asn Asp Asp Asp Val Ser Tyr Tyr Gly Tyr Gly Thr Ile Gly Thr Asp Leu Lys Val Thr
Val His Asn Glu Gly Asn Asn Thr Met Ile Val Gln Asp Arg Ile Leu Arg Trp Ile Asp Met Pro Val
Val Ile Glu Glu Val Gln Lys Gln Gly Ser Gln Val Thr Ile Lys Gly Asn Ala Ile Lys Asn Gly Val
Leu Thr Ile Asn Gly Glu Arg Val Pro Ile Asp Gly Arg Met Ala Phe Ser Tyr Thr Phe Ala Pro Ala
Ser His Gln Lys Glu Val Leu Ile His Ile Glu Pro Ser Ala Glu Ser Lys Thr Ala Ile Phe Asn Asn Asp



Figure 16GG

Gly Gly Ala Ile Ala Lys Asn Thr Lys Asp Tyr Val Leu Asn Leu Glu Thr Lys Gln Phe Lys Lys Leu
Leu Glu Ser Thr Ser Arg Ala Ala Ala Gly Pro Ser Ile Phe His Pro Gly Gly Val Pro Gly

SEQ ID NO: 91

gtgctaacgtttaccgcatcattcgaaaaggatggatgttcctgctcgcgttttgcactgcctcgtgttctgcccacaggacagcccgcc
aggtgcgcgaccgtttaacggcaccatgatgcagattttgaatggacttgccggatgatggcacgttatggacaaagtggccaatgaagc
caacaactatccagccttggcatcaccgctctttggctgccgccgcttataaaggaacaagccgcagcgacgtagggtacggagtatacga
cttgatgacctcgcgcaattcaatcaaaaagggaccgtccgcacaaaatacggaaacaaaagctcaatatcttcaagccattcaagccgccac
gccgctggaatgcaagtgtacgccgatgtcgtgttcgaccataaaggcggcgccgacggcacggaatgggtggacgccgtcgaagtcaatc
cgccgaccgcaaccaagaaatctcgggcacctatcaatccaagcatggacgaaatttgatttccggggcggggcaacacctactccagctt
taagtggcgctgggtaccattttgacggcgttgattgggacgaaagccgaaaattgagccgcattacaaattccggcgcatcggaagcgtgg
gattgggaagtagacacggaaacggaaactatgactcttaattgatgccgacttgacatggaccatcctgaagtgggttacggaactgaaaa
actggggcaaatggatgtcaacacaacgaacattgatgggttccggcttgatgccgtaagcataattaagttcagtttttctgattggtgtcgt
atgtgcgttctcagactggcaagccgctattaccgctcgggaatattggagctatgacatcaacaagttgcacaattacattacgaaacaaacg
gaacgatgtctttgttgatccccgttacacaacaaattttataccgcttccaaatcagggggcgcatgtgatgcgcacgttaataaccaatact
ctcatgaaagatcaaccgacattggcgcaccttctgtgataatcatgacaccgaaccggccaagcgctgcagtcattgggtcgaccatggt
tcaaaccgttgcttacgctttattctaactcggcaggaaggataaccgtgcgtctttatggtgactattatggcatccacaaatataacattcctt
cgtgaaagcaaaatcgatccgctcctcatcgcgcgaggattatgcttacggaacgcaacatgattatcttgatcactccgacatcatcggt
tggaacagggaaggcgtcactgaaaaaccaggatccggactggcgcgactgatcaccgatggggccgggaggaagcaaatggatgtacgtt
ggcaacaacacgccggaaggtgtctatgacctaccggcaaccggagtgacaccgtcaccatcaacagtgatggatggggagaattcaa
agtcaatggcgggttcggttcggttggttcctagaaaaacgaccgtctctaccatcgcttggccgatcacaacccgaccgtggactggtgaatt
cgccggttgaccgaaccacgggttggtggcatggccttga

SEQ ID NO: 92

Val Leu Thr Phe His Arg Ile Ile Arg Lys Gly Trp Met Phe Leu Leu Ala Phe Leu Leu Thr Ala Ser
Leu Phe Cys Pro Thr Gly Gln Pro Ala Lys Ala Ala Ala Pro Phe Asn Gly Thr Met Met Gln Tyr Phe
Glu Trp Tyr Leu Pro Asp Asp Gly Thr Leu Trp Thr Lys Val Ala Asn Glu Ala Asn Asn Leu Ser Ser
Leu Gly Ile Thr Ala Leu Trp Leu Pro Pro Ala Tyr Lys Gly Thr Ser Arg Ser Asp Val Gly Tyr Gly
Val Tyr Asp Leu Tyr Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr
Lys Ala Gln Tyr Leu Gln Ala Ile Gln Ala Ala His Ala Ala Gly Met Gln Val Tyr Ala Asp Val Val
Phe Asp His Lys Gly Gly Ala Asp Gly Thr Glu Trp Val Asp Ala Val Glu Val Asn Pro Ser Asp Arg
Asn Gln Glu Ile Ser Gly Thr Tyr Gln Ile Gln Ala Trp Thr Lys Phe Asp Phe Pro Gly Arg Gly Asn
Thr Tyr Ser Ser Phe Lys Trp Arg Trp Tyr His Phe Asp Gly Val Asp Trp Asp Glu Ser Arg Lys Leu
Ser Arg Ile Tyr Lys Phe Arg Gly Ile Gly Lys Ala Trp Asp Trp Glu Val Asp Thr Glu Asn Gly Asn
Tyr Asp Tyr Leu Met Tyr Ala Asp Leu Asp Met Asp His Pro Glu Val Val Thr Glu Leu Lys Asn
Trp Gly Lys Trp Tyr Val Asn Thr Thr Asn Ile Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Lys
Phe Ser Phe Phe Pro Asp Trp Leu Ser Tyr Val Arg Ser Gln Thr Gly Lys Pro Leu Phe Thr Val Gly
Glu Tyr Trp Ser Tyr Asp Ile Asn Lys Leu His Asn Tyr Ile Thr Lys Thr Asn Gly Thr Met Ser Leu
Phe Asp Ala Pro Leu His Asn Lys Phe Tyr Thr Ala Ser Lys Ser Gly Gly Ala Phe Asp Met Arg Thr
Leu Met Thr Asn Thr Leu Met Lys Asp Gln Pro Thr Leu Ala Val Thr Phe Val Asp Asn His Asp
Thr Glu Pro Gly Gln Ala Leu Gln Ser Trp Val Asp Pro Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile
Leu Thr Arg Gln Glu Gly Tyr Pro Cys Val Phe Tyr Gly Asp Tyr Tyr Gly Ile Pro Gln Tyr Asn Ile
Pro Ser Leu Lys Ser Lys Ile Asp Pro Leu Leu Ile Ala Arg Arg Asp Tyr Ala Tyr Gly Thr Gln His
Asp Tyr Leu Asp His Ser Asp Ile Ile Gly Trp Thr Arg Glu Gly Val Thr Glu Lys Pro Gly Ser Gly
Leu Ala Ala Leu Ile Thr Asp Gly Pro Gly Gly Ser Lys Trp Met Tyr Val Gly Lys Gln His Ala Gly
Lys Val Phe Tyr Asp Leu Thr Gly Asn Arg Ser Asp Thr Val Thr Ile Asn Ser Asp Gly Trp Gly Glu
Phe Lys Val Asn Gly Gly Ser Val Ser Val Trp Val Pro Arg Lys Thr Thr Val Ser Thr Ile Ala Trp
Pro Ile Thr Thr Arg Pro Trp Thr Gly Glu Phe Val Arg Trp Thr Glu Pro Arg Leu Val Ala Trp Pro

Figure 16HH



SEQ ID NO: 93

atgaaatcgttgcattcatgcctatcctttttatgcaaacgatttcacagtgaaagggaaggaggaggagaaaaatggggaagaatatgagaaga
agattcacgtattttcaatctcttattgttcgttcagctgttttcatttagtgaaccgctagcgccaatggaacggtagaacagtagtctgttggttaa
tggaacgaagtcacgtttctatatggaggaacaggaaacgagcagctgtgttactggcaggctccttaattgattggcagaagaatgggtgaca
agaagattgcactaacaanaaggcgacaataacgtctgtgtgtcagcgaacacttcaagatgggacatatagctataagttgtgttagatggc
aatgggtggcggatccgcttaaccgaatcaagtagacgacgggttacggcggcgttaatagtgtcgttgtgtcgggacacgggtgcaacaag
aacggacagtgacgcttgttgtaactacaagacgaattaggtcatagcagcgaatgggatccgaaagcgacagctacagtgatgaaaaagg
aagggaacgggttatatacgtttacaggtacacttccagccggaacgtacgagtataaattgcgattaatggcagctgggacgaaaactatggt
gtcggcggcgcgatggcgggaatattaagctgctattaatgaacaaacaacgggttaccattttattacaacgacagaacgcagtgatgagg
attcgacttggtatgcaccaattctaaaagaaaagcagccgcggctcgttggacgattttaccagctattggtatgaaacagacgtgaacgggt
ggacgccgcaaacatcaacggcgttgtgtcagatgatgattttgattccatttatacgtttaaggcgcgtgtgcaaaaaggacatatgaatataa
agtagttcttgggaatgattggacatatgaaaattatccacaagataatgccaaataaatgtgctgaagaacgacaattaccttttcttaacgc
gaaaacgaaagtagtgataccgattacaatccaagcgggttcggatggtatcgtccaaaagaccggttgaagcataatacgtgggattcgttgta
tcgccaaccggttgggtgcggtgaaagctgggacagaagtgacccttcgtttatcagcgaaaaaagggtgatttgacaaaagcggtatgatataa
aaaatacgaacccggcagcgaaactatattcgatgaaaaaagccgggtgttcttggcgaagaagaattattgggaagcgacattcacaccgg
atgtgaaaggagtatacgggtataaattattgcggtagatgctggaacgaaagcagaatacggggaagatacacaagaagggcagtgggga
aaagcagtagataaaaaatgcagagctgttccaattaacgggtgtacgacctacccaacaccggattggatgaaagaagcagttgtatatca
aatttccctgatccaaag

SEQ ID NO: 94

Met Lys Ser Phe Ala Phe Met Pro Ile Leu Phe Tyr Ala Asn Asp Phe Ile Ser Glu Arg Glu Gly Gly
Gly Lys Met Gly Lys Asn Met Arg Arg Arg Phe Thr Tyr Phe Ser Ile Phe Leu Leu Phe Val Gln Leu
Phe Ser Phe Ser Ala Thr Ala Ser Ala Asn Gly Thr Val Asn Ser Ser Pro Val Val Asn Gly Asn Glu
Val Thr Phe Leu Tyr Gly Gly Thr Gly Asn Glu Gln Ser Val Leu Leu Ala Gly Ser Phe Asn Asp Trp
Gln Lys Asp Gly Asp Lys Lys Ile Ala Leu Thr Lys Gly Asp Asn Asn Val Trp Ser Val Thr Gln Thr
Leu Gln Asp Gly Thr Tyr Thr Tyr Lys Phe Val Val Asp Gly Gln Trp Val Ala Asp Pro Leu Asn Pro
Asn Gln Val Asp Asp Gly Tyr Gly Gly Arg Asn Ser Val Val Val Val Gly Thr Pro Val Gln Gln Glu
Arg Thr Val Thr Leu Val Gly Asn Leu Gln Asp Glu Leu Gly His Thr Ser Glu Trp Asp Pro Lys Ala
Thr Ala Thr Val Met Lys Lys Glu Gly Asn Gly Leu Tyr Thr Phe Thr Gly Thr Leu Pro Ala Gly Thr
Tyr Glu Tyr Lys Ile Ala Ile Asn Gly Ser Trp Asp Glu Asn Tyr Gly Val Gly Gly Arg Asp Gly Gly
Asn Ile Lys Leu Leu Leu Asn Glu Gln Thr Thr Val Thr Phe Tyr Tyr Asn Asp Arg Thr His Ala Ile
Ala Asp Ser Thr Trp Tyr Ala Pro Ile Leu Lys Glu Lys Gln Pro Arg Leu Val Gly Thr Ile Leu Pro
Ala Ile Gly Tyr Glu Thr Asp Val Asn Gly Trp Thr Pro Gln Thr Ser Thr Ala Leu Leu Ser Asp Asp
Asp Phe Asp Ser Ile Tyr Thr Phe Lys Ala Arg Val Pro Lys Gly Thr Tyr Glu Tyr Lys Val Val Leu
Gly Asn Asp Trp Thr Tyr Glu Asn Tyr Pro Gln Asp Asn Ala Lys Leu Asn Val Leu Glu Glu Thr
Thr Ile Thr Phe Phe Phe Asn Ala Lys Thr Lys Val Val Tyr Thr Asp Tyr Asn Pro Ser Gly Ser Asp
Gly Ile Val Gln Lys Asp Arg Leu Lys His Asn Thr Trp Asp Ser Leu Tyr Arg Gln Pro Phe Gly Ala
Val Lys Ala Gly Thr Glu Val Thr Leu Arg Leu Ser Ala Lys Lys Gly Asp Leu Thr Lys Ala Asp Val
Tyr Val Lys Asn Thr Thr Thr Gly Thr Ala Lys Leu Tyr Ser Met Lys Lys Ala Gly Val Leu Gly Glu
Glu Glu Tyr Trp Glu Ala Thr Phe Thr Pro Asp Val Lys Gly Val Tyr Gly Tyr Lys Phe Ile Ala Val
Asp Ala Gly Thr Lys Ala Glu Tyr Gly Glu Asp Thr Gln Glu Gly Gln Trp Gly Lys Ala Val Asp Lys
Asn Ala Glu Leu Phe Gln Leu Thr Val Tyr Asp Pro Ser Tyr Gln Thr Pro Asp Trp Met Lys Glu Ala
Val Val Tyr Gln Ile Phe Pro Asp Pro Lys

SEQ ID NO: 95

atgtatacactattcatccgttcataattttgatactgatggtgatggtgtaggagacttttagtgagttgctgaaaaaggtagattatctaaaatctcttg
gagtatgatacagctcgtgttttaccatttaataaaaagtaaatcttatcatggatatgatgttgaaagattactatgatgtagaaccagattatggaacact
acaagatcttgataatatgataaaagtctaaatgaaaatggaataaaggtagtaatggatcttgttgtaatcatagctcggatacacatccatggtt
tcttgatgcagttgaaaatactactaattctccatattggaactattacattatgagcttgatgagcctcaaaaataagaatcattggcattataagggt
aattcaaaaggacaaactgtgtgttatttggattgtttgattcatcaatgccggaccttaattacgacaaccctaaagtaatggatgaagtga

Figure 16II



Applicant(s): Walter Callen et al.
ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

aataatagattttgggcagatatgggagtagatggatttagattagatgcagcaaacattattatggatttgactggagcgatggaattgaacag
tcagcaagcgttgcaaaagagatagaagactatataaaagataaactaggggaaaatgcaatagttgtgagtgagggttacgatggagattcaa
atgttcttttaaaattgtcctcaatgcctgtgttaattttatgtttatgtacaatttgagaggaaaatttgaaggagagataacttaatttcagactctatt
agttgggttgattcctcgtgtataatttaaatgttttcattttccatttattgatagtcatgactcttgacagatttattctgagctttagatagtaaatatc
agggagatgtaatatctgccacaaaacaatatttgcctagtttaagtcttactactctcattaacagggcatgccaactatttactatgggtgatgaaatag
gacttaggggatggaagtggcattcagaaccatgggatatacctgtgcgtgagccaatgcaatgggtataaggatcaaaaagggaacgggtcaaa
cttattggacaaaagagttttacgaaggtattactgaaggaagtgtctaatgaagatggagcaatatac gatgatccagatgatggagtatctgtag
aagaacaagaaaatggatattctattttaaacttttttaagaatttatcaacttacgaaaagattatccggcacttgcttttgaagtactacgattga
gagagattggaaaacttgatgttttgaaaaagtcgtataactccaggatgttctgtattaattaaccttgatccaacgtattcaaatacatacga
gtccagaagggtataaatgggtgtggtatgcatttttgatgggtgacaactatgaatttggagcaaaagatgaaatgattttacagaatacaagttg
gacgataaatccaaggcaatttatatttgaagtaa

SEQ ID NO: 96

Met Tyr Thr Leu Phe Ile Arg Ser Tyr Phe Asp Thr Asp Gly Asp Gly Val Gly Asp Phe Ser Gly Val
Ala Glu Lys Val Asp Tyr Leu Lys Ser Leu Gly Val Asp Thr Val Trp Phe Leu Pro Phe Asn Lys Ser
Lys Ser Tyr His Gly Tyr Asp Val Glu Asp Tyr Tyr Asp Val Glu Pro Asp Tyr Gly Thr Leu Gln Asp
Leu Asp Asn Met Ile Lys Val Leu Asn Glu Asn Gly Ile Lys Val Val Met Asp Leu Val Val Asn His
Thr Ser Asp Thr His Pro Trp Phe Leu Asp Ala Val Glu Asn Thr Thr Asn Ser Pro Tyr Trp Asn Tyr
Tyr Ile Met Ser Leu Asp Glu Pro Gln Asn Lys Asn His Trp His Tyr Lys Val Asn Ser Lys Gly Gln
Thr Val Trp Tyr Phe Gly Leu Phe Asp Ser Ser Met Pro Asp Leu Asn Tyr Asp Asn Pro Lys Val Met
Asp Glu Val Lys Lys Ile Ile Asp Phe Trp Ala Asp Met Gly Val Asp Gly Phe Arg Leu Asp Ala Ala
Lys His Tyr Tyr Gly Phe Asp Trp Ser Asp Gly Ile Glu Gln Ser Ala Ser Val Ala Lys Glu Ile Glu
Asp Tyr Ile Lys Asp Lys Leu Gly Glu Asn Ala Ile Val Val Ser Glu Val Tyr Asp Gly Asp Ser Asn
Val Leu Leu Lys Phe Ala Pro Met Pro Val Phe Asn Phe Ser Phe Met Tyr Asn Leu Arg Gly Asn
Phe Glu Gly Arg Asp Asn Leu Ile Ser Asp Ser Ile Ser Trp Val Asp Ser Ser Leu Tyr Asn Leu Asn
Val Phe His Phe Pro Phe Ile Asp Ser His Asp Leu Asp Arg Phe Ile Ser Glu Leu Val Asp Ser Lys
Tyr Gln Gly Asp Val Ile Ser Ala Thr Lys Gln Tyr Leu Leu Val Asn Ala Leu Leu Leu Ser Leu Thr
Gly Met Pro Thr Ile Tyr Tyr Gly Asp Glu Ile Gly Leu Arg Gly Trp Lys Trp His Ser Glu Pro Trp
Asp Ile Pro Val Arg Glu Pro Met Gln Trp Tyr Lys Asp Gln Lys Gly Asn Gly Gln Thr Tyr Trp Thr
Lys Glu Phe Tyr Glu Gly Ile Thr Glu Gly Ser Ala Asn Glu Asp Gly Ala Ile Tyr Asp Asp Pro Asp
Asp Gly Val Ser Val Glu Glu Gln Glu Asn Gly Tyr Ser Ile Leu Asn Phe Phe Lys Glu Phe Ile Asn
Leu Arg Lys Asp Tyr Pro Ala Leu Ala Phe Gly Ser Thr Thr Ile Glu Arg Asp Trp Lys Asn Leu Tyr
Val Leu Lys Lys Ser Tyr Asn Phe Gln Asp Val Leu Val Leu Ile Asn Leu Asp Pro Thr Tyr Ser Asn
Thr Tyr Glu Val Pro Glu Gly Tyr Lys Trp Val Trp Tyr Ala Phe Phe Asp Gly Asp Asn Tyr Glu Phe
Gly Ala Lys Asp Glu Met Ile Leu Gln Asn Thr Ser Trp Thr Ile Asn Pro Arg Gln Ile Tyr Ile Phe Val
Lys

SEQ ID NO: 97

atgaggaagaagatgtcgcattcaagattacttttcttttgatcttagcactttttatttcttccggttgatttcagaagttaaagcgaaagccag
ctactaaattcaaaagcaaaaggtcctgttaaagtaaattgtaatacgcatttattgagaatgctactactaatcgtggagtgttcaaaagaatct
tttattgattatcttagtaaagtgattattactgttaaggatgtaaatgatcagattgtatttactaaggaaacaacgaacaaacaaatatttttgaa
attgaacttctcctggaacttatacatttgaggtaaaaggatatgaggaagatttagttatatttcagggggaaaaagtaatcagatcatagatgag
aaaaataatattgtaattgtcgaactttttgttaagtgaatagttaggacaataattgaagttgacgatattattataaaaattatgatattacatcg
caacgttgatcttcaaaaaagatacagcacaagaagattatgaagaggtacctgtaacacttacaggtactccactttaattaagaattatat
cctggatgtggactgtaaaaattgaagttgatcttaaatcaaggatgcaagtagttaccagaaaaagttcatcttgaaaatgaatttagcataga
agtgtccagcaaaagacaaaaagtttaacatttaattgtagtctttgatacagaggttaattgaaccgaaattagtagttgatttccgcaaattgagtt
gctttttgtgatacctgttaacaaatttaagtgagagataaatgaattagaagggaatctttcaatgaattgggactattcagatccaaatgcagaat
tttatgtgtataaagaattagaggaacaaggagaattttgtatgaattgttgaaaaacacgcgagaaaagttatacaatagaaaattttaccaag
caagaattcgataaatttagtggaatcgcttaattgtttatgccaacggtaagagagtgattagttgttcaaaaaaagaaaattataaacttata
gatttagaaagtgttgacagtataagtgcacttataacgttgatacgaatgagcttaagttgattggaattataccaattcaagtgttactttgaag



Figure 16JJ

ttttgaaaaaagggtataaatagcaatgaatacgaataatttctcaactaacacaaaattcttttcaacagaattcacaggcaggcaattttgggac
ttgagaaaattgcgattagagtagtgctaatggatttgaaagtaagattaatgagatttcaagagatgataactataacatcattgaatcttctct
tacatcgctactatgtatacactattcatccgttcataatttgatactgatggtaggtgtaggagactttagtgagtgctgaaaaggtagattac
taaaatctcttgagtagatagacgtctggttttaccatttaataaaagtaaatcttatcatggatatgatgtgaagattactatgatgtagaaccagat
tatggaactacacagatcttgataatgataaaagtctaaatgaaaatggaataaaggtagtaatggatcttggtgtaatacatacgtcggatac
acatccatgggttcttgatgcagttgaaaatactactaattctccatattggaactattacattatgagcttgatgagcccaaaaataagaatcattgg
cattataaggtaattcaaaaggacaaactgtgtggtattttggattgttgattcatcaatgccggacctaattacgacaacctaaagtaatggat
gaagtgaaaaaataatagatttttgggcagatatgggagtagatggatttagattagatgcagcaaaacattattatggatttgactggagcgatg
gaattgaacagtcagcaagcgttgcaaaagagatagaagactatataaaagataaactaggggaaaatgcaatagttgtgagtgaggttacga
tgagattcaaatgttcttttaaaattgtctcaatgcctgtgttaattttgattttatgtacaatttgagaggaaattttgaaggagagataactaatt
tcagactctatttagttgggtgattcctcgtgtataaattaaatgttttcatcttccattattgatagtcatgatcttgacagatttttctgagctttag
atagtaaatatcagggagatgtaatatctgccacaaaacaattttgtagttaatgctttactactctcattaacaggcatgccaaactatttactatgg
tgatgaaataggacttaggggatggaagtggcattcagaacctgggatatacctgtgcgtgagccaatgcaatggtataaggatcaaaaagg
gaacggtcaaacattattggacaaaagagtttacgaaggtattactgaaggaaagtctaataagatggagcaatatacgaatccagatgatg
gagtatctgtagaagaacaagaaaatggatattctattttaaacttttttaagaatttatcaactacgaaaagattatccggcactgtcttgggaagt
actacgattgagagagattggaaaacttgatgtttgaaaaagtcgtataactccaggatgttctgtattaattaaccttgatccaacgtattcaa
atacatcgaagttccagaaggggtataaatgggtgtgtatgcatttttgatggtgacaactatgaatttgagcaaaagatgaaatgattttacag
aatacaagttggacgataaatccaaggcaatttatattgttaaagtaa

SEQ ID NO: 98

Met Arg Lys Lys Met Ser His Ser Arg Phe Thr Phe Leu Leu Ile Leu Ala Leu Phe Ile Phe Phe Ser
Gly Cys Ile Ser Glu Val Lys Ser Glu Ser Gln Leu Leu Asn Ser Lys Gln Lys Val Leu Val Lys Val
Asn Val Asn Thr Pro Phe Ile Glu Asn Ala Thr Thr Asn Thr Trp Ser Val Ser Lys Glu Ser Phe Ile
Asp Tyr Leu Ser Lys Val Ile Ile Thr Val Lys Asp Val Asn Asp Gln Ile Val Phe Thr Lys Glu Thr
Thr Asn Lys Thr Asn Ile Tyr Phe Glu Ile Glu Leu Leu Pro Gly Thr Tyr Thr Phe Glu Val Lys Gly
Tyr Glu Glu Asp Leu Val Ile Phe Ser Gly Glu Lys Val Asn Gln Ile Ile Asp Glu Lys Asn Asn Ile
Val Asn Val Glu Thr Phe Phe Val Asn Gly Ile Val Arg Thr Ile Ile Glu Val Asp Asp Ile Ile Tyr Lys
Asn Tyr Asp Ile Thr Ser Ala Thr Leu Ile Phe Lys Lys Asp Thr Ala Gln Glu Asp Tyr Glu Glu Val
Pro Val Thr Leu Thr Gly Thr Ser Thr Leu Ile Asn Lys Glu Leu Tyr Pro Gly Met Trp Thr Val Lys
Phe Glu Val Asp Leu Lys Ser Lys Asp Ala Ser Met Leu Pro Glu Lys Val His Leu Glu Asn Glu Phe
Ser Ile Glu Val Leu Pro Ala Lys Thr Lys Ser Leu Thr Phe Asn Val Val Phe Asp Thr Glu Val Asn
Glu Pro Lys Leu Val Val Val Phe Pro Gln Ile Glu Leu Pro Phe Val Asp Pro Val Thr Asn Leu Ser
Gly Glu Ile Asn Glu Leu Glu Gly Asn Leu Ser Met Asn Trp Asp Tyr Ser Asp Pro Asn Ala Glu Phe
Tyr Val Tyr Lys Glu Leu Glu Glu Gln Gly Glu Tyr Leu Tyr Glu Phe Val Gly Lys Thr Arg Glu Lys
Ser Tyr Thr Ile Glu Asn Phe Thr Lys Gln Glu Phe Asp Lys Phe Ser Gly Ile Ala Ile Asn Val Tyr
Ala Asn Gly Lys Glu Ser Gly Leu Val Val Leu Lys Lys Glu Asn Ile Lys Leu Ile Asp Leu Glu Ser
Val Asp Ser Ile Ser Ala Thr Tyr Asn Val Asp Thr Asn Glu Leu Lys Leu Asp Trp Asn Tyr Thr Asn
Ser Ser Val Thr Phe Glu Val Leu Lys Lys Gly Ile Asn Ser Asn Glu Tyr Glu Ile Ile Ser Gln Leu Thr
Gln Asn Ser Phe Ser Thr Glu Phe Thr Gly Arg Gln Phe Trp Asp Leu Glu Lys Ile Ala Ile Arg Val
Val Ala Asn Gly Phe Glu Ser Lys Ile Asn Glu Ile Ser Arg Asp Asp Ile Thr Ile Thr Ser Leu Asn Leu
Pro Leu Thr Ser Ser Thr Met Tyr Thr Leu Phe Ile Arg Ser Tyr Phe Asp Thr Asp Gly Asp Gly Val
Gly Asp Phe Ser Gly Val Ala Glu Lys Val Asp Tyr Leu Lys Ser Leu Gly Val Asp Thr Val Trp Phe
Leu Pro Phe Asn Lys Ser Lys Ser Tyr His Gly Tyr Asp Val Glu Asp Tyr Tyr Asp Val Glu Pro Asp
Tyr Gly Thr Leu Gln Asp Leu Asp Asn Met Ile Lys Val Leu Asn Glu Asn Gly Ile Lys Val Val Met
Asp Leu Val Val Asn His Thr Ser Asp Thr His Pro Trp Phe Leu Asp Ala Val Glu Asn Thr Thr Asn
Ser Pro Tyr Trp Asn Tyr Tyr Ile Met Ser Leu Asp Glu Pro Gln Asn Lys Asn His Trp His Tyr Lys
Val Asn Ser Lys Gly Gln Thr Val Trp Tyr Phe Gly Leu Phe Asp Ser Ser Met Pro Asp Leu Asn Tyr
Asp Asn Pro Lys Val Met Asp Glu Val Lys Lys Ile Ile Asp Phe Trp Ala Asp Met Gly Val Asp Gly
Phe Arg Leu Asp Ala Ala Lys His Tyr Tyr Gly Phe Asp Trp Ser Asp Gly Ile Glu Gln Ser Ala Ser
Val Ala Lys Glu Ile Glu Asp Tyr Ile Lys Asp Lys Leu Gly Glu Asn Ala Ile Val Val Ser Glu Val

Figure 16KK



Applicant(s): Walter Callen et al.
ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

Tyr Asp Gly Asp Ser Asn Val Leu Leu Lys Phe Ala Pro Met Pro Val Phe Asn Phe Ser Phe Met Tyr
Asn Leu Arg Gly Asn Phe Glu Gly Arg Asp Asn Leu Ile Ser Asp Ser Ile Ser Trp Val Asp Ser Ser
Leu Tyr Asn Leu Asn Val Phe His Phe Pro Phe Ile Asp Ser His Asp Leu Asp Arg Phe Ile Ser Glu
Leu Val Asp Ser Lys Tyr Gln Gly Asp Val Ile Ser Ala Thr Lys Gln Tyr Leu Leu Val Asn Ala Leu
Leu Leu Ser Leu Thr Gly Met Pro Thr Ile Tyr Tyr Gly Asp Glu Ile Gly Leu Arg Gly Trp Lys Trp
His Ser Glu Pro Trp Asp Ile Pro Val Arg Glu Pro Met Gln Trp Tyr Lys Asp Gln Lys Gly Asn Gly
Gln Thr Tyr Trp Thr Lys Glu Phe Tyr Glu Gly Ile Thr Glu Gly Ser Ala Asn Glu Asp Gly Ala Ile
Tyr Asp Asp Pro Asp Asp Gly Val Ser Val Glu Glu Gln Glu Asn Gly Tyr Ser Ile Leu Asn Phe Phe
Lys Glu Phe Ile Asn Leu Arg Lys Asp Tyr Pro Ala Leu Ala Phe Gly Ser Thr Thr Ile Glu Arg Asp
Trp Lys Asn Leu Tyr Val Leu Lys Lys Ser Tyr Asn Phe Gln Asp Val Leu Val Leu Ile Asn Leu Asp
Pro Thr Tyr Ser Asn Thr Tyr Glu Val Pro Glu Gly Tyr Lys Trp Val Trp Tyr Ala Phe Phe Asp Gly
Asp Asn Tyr Glu Phe Gly Ala Lys Asp Glu Met Ile Leu Gln Asn Thr Ser Trp Thr Ile Asn Pro Arg
Gln Ile Tyr Ile Phe Val Lys

SEQ ID NO: 99

atgtacacactcttctccgctcttttacgatacaaaacacgacggtgtaggtgactacaacggtgtgccccaaaagtagactatctcaaaacg
cttgagtggtgatacagtttggttcttgcggttcaacaaagcaaatcgaccacggttacgatgtgaagactactacgatgtagaacctgactatg
gaacatacgcacaacttgaaaatgataaagacactcaatcagaacggaattcgtgttatggacttggtgtgaaccacactccgatacac
actcgtggttcttggtgagcgttgagaacacacgaattcgaatatggagctactacataatgacacttgaaaatagagacggttggaatcact
ggcattggaagataaactcaaaagggcaaaaagttactactcggactgttgactcatcaatgcccgatttgaaattcgacaatccacaagtgtat
gaacgaaatcaagagaataatcgatttctggataacagttggtgtggtggttcagacttgatgcacaaagcactacaaggtggtggtggtg
acgacggcatttcaggttcagcagcaatcgcgagggaaatagaagttacatcaggagcaagttaggaacgatgcgatagtgtcggtgggaa
gtgtacgatggaatccatcggttcttcacaatttgcaccgatccggcgttcaacttcacattcatgtatggaataacaggcaacctatgagggg
aaagataacctgctgggagaaacaatttcatgggttaattggagcaggttattatctcaacgtaaaacatttccggttcatagacaatcacgattga
acagatggatcgcgatactatcgacaaaagtatagtgaaacacacaagttgtacgaagcagtatatttaacaaatgcgctcttgccttctta
aacggtatgcctgttattattatgggaatgaaataggcctgagaggatggaatggggacaagaccggtggattgcccgtgagagagccga
tgcagtgggtacgcaagtcaaatggagctgggcagacatggtggacaaagcctgtctaccagcaaaaggaatcacatttggaatgcaaac
gtcgtatggtgcgatgtacgatgacaaatgatgggttctcagtagaagagcagatgaatggttacacgataaataacttcttaacaattcataa
ccctgaggaagacatatcgggtctatcgaaaggttcgataacgatagaacgcgactggaagaacctgtacgttatcaaacgagctacggaa
atcaggaagtgtgtattgataaacttagaccaacttgccgaacaattacacgttaccaggtggatacaggtgggtctggtatgcgttcttaa
tgggagttgtttgaatttggcaataaaaacgaatcaccactgagccaagataccaactggacagtcgaatccaaggcaagtgtatgtgtttgtgaa
ggactaa

SEQ ID NO: 100

Met Tyr Thr Leu Phe Ile Arg Ser Phe Tyr Asp Thr Asn Asn Asp Gly Val Gly Asp Tyr Asn Gly Val
Ala Gln Lys Val Asp Tyr Leu Lys Thr Leu Gly Val Asp Thr Val Trp Phe Leu Pro Phe Asn Lys Ala
Lys Ser Tyr His Gly Tyr Asp Val Glu Asp Tyr Tyr Asp Val Glu Pro Asp Tyr Gly Thr Tyr Ala Gln
Leu Glu Asn Met Ile Lys Thr Leu Asn Gln Asn Gly Ile Arg Val Val Met Asp Leu Val Val Asn His
Thr Ser Asp Thr His Ser Trp Phe Leu Asp Ala Val Glu Asn Thr Thr Asn Ser Lys Tyr Trp Ser Tyr
Tyr Ile Met Thr Leu Glu Asn Arg Asp Gly Trp Asn His Trp His Trp Lys Ile Asn Ser Lys Gly Gln
Lys Val Tyr Tyr Phe Gly Leu Phe Asp Ser Ser Met Pro Asp Leu Asn Phe Asp Asn Pro Gln Val
Met Asn Glu Ile Lys Arg Ile Ile Asp Phe Trp Ile Thr Val Gly Val Asp Gly Phe Arg Leu Asp Ala
Pro Lys His Tyr Lys Gly Trp Asp Trp Asp Asp Gly Ile Ser Gly Ser Ala Ala Ile Ala Arg Glu Ile Glu
Ser Tyr Ile Arg Ser Lys Leu Gly Asn Asp Ala Ile Val Val Gly Glu Val Tyr Asp Gly Asn Pro Ser
Val Leu Ser Gln Phe Ala Pro Met Pro Ala Phe Asn Phe Thr Phe Met Tyr Gly Ile Thr Gly Asn His
Glu Gly Lys Asp Asn Leu Leu Gly Glu Thr Ile Ser Trp Val Asn Gly Ala Ser Tyr Tyr Leu Asn Val
Lys His Phe Pro Phe Ile Asp Asn His Asp Leu Asn Arg Trp Ile Ser Ile Leu Ile Asp Gln Lys Tyr Ser
Gly Asn Thr Gln Val Gly Thr Lys Gln Tyr Ile Leu Thr Asn Ala Leu Leu Leu Ser Leu Asn Gly Met
Pro Val Ile Tyr Tyr Gly Asn Glu Ile Gly Leu Arg Gly Trp Lys Trp Gly Gln Asp Pro Trp Asp Leu
Pro Val Arg Glu Pro Met Gln Trp Tyr Ala Ser Gln Ser Gly Ala Gly Gln Thr Trp Trp Thr Lys Pro

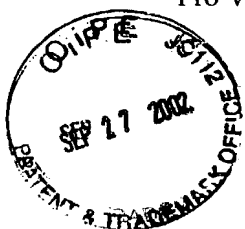


Figure 16LL

Val Tyr Gln Gln Lys Gly Ile Thr Phe Gly Asn Ala Asn Val Asp Gly Ala Met Tyr Asp Asp Pro Asn
Asp Gly Val Ser Val Glu Glu Gln Met Asn Gly Tyr Thr Ile Asn Asn Phe Phe Lys Gln Phe Ile Thr
Leu Arg Lys Thr Tyr Pro Ala Leu Ser Lys Gly Ser Ile Thr Ile Glu Arg Asp Trp Lys Asn Leu Tyr
Val Ile Lys Arg Val Tyr Gly Asn Gln Glu Val Leu Val Leu Ile Asn Leu Asp Pro Thr Trp Pro Asn
Asn Tyr Thr Leu Pro Gly Gly Tyr Arg Trp Val Trp Tyr Ala Phe Phe Asn Gly Ser Leu Phe Glu Phe
Gly Asn Lys Asn Glu Ser Pro Leu Ser Gln Asp Thr Asn Trp Thr Val Asn Pro Arg Gln Val Tyr Val
Phe Val Lys Asp

SEQ ID NO: 101

ttgcgattctttccaaagtaatatccccctttccgcaaaacaccagagagtggcagcgaagcgcagtatcaagagacactgaacaattacaaag
gaaagtaataatgatcaatttgaaaaaaacaccattagcgcccttggtcgcaggtatggtattaggctttgcatccaacgcaatggcggttctag
aacgcgtttgtacacctctttgaatggaaatgggaagatgttgacaggagtgtgaaacattctcggacctaaaggctttgccgcagtgaagt
ctctccgccaactaaatcacaacacggatgcatggtggggccggtatcaaccgtagttatgctttgaaggacgcagcggtaatcgagcc
aatttaaaatatggtgcaacgttgaaagctgtaggcgtcgatatactagtagatgcagtgaataaccacatggcagcctacgacagaaattcc
cigtatgtaccctatagcagtaatgactttaactcctgtacaggagatattgactataataaccgttgcaaacacagcattgtgattagtcggtctta
atgatctaaaaacaggatctgactacgtccgcaaaaaatagcggattatgaacgacgcaatcagtagtggtgtagctggtttccgtattgatg
cagccaaacatataccagcaggtgatatactgcccattaaaggtaataaattgtaattccatacatctccaagaggtaattggtgcatccggcg
aacctgttcgaccgactgaatacacctttatcggtggtgtcacggaattcaatttgcgtaaaattgggtccagcctccgcaatgtaattgctt
gggttaaaagacattggcagtcgaatggaattatccagtgctgatgccgtaacatttgaacgaatcatgatgaagagcgtcataaccggaatggtc
ctatttggcacggcggttaaggaattggttatgcatagcaaatatttcaccttagcttaccctacggctatccaaaaatcatgtcaggatactctt
ccacggtgactttaacgcagctccaccaagcagtggtatatacacacaggaaatgcgtgtggtttgatggcggagactgggtatgcgaacacaa
atggcgcggtattgctaacaatggttgcctccgcaactatacagcaagcgaatggcgatcagtaattggtggcaaaacagtaacgaccaaattg
cttttggcgcggtggttttaggtttgtgtattataaaacgtgctaattgtagcattaatcaaaagtttgatacgggaatgcctgatggccaatactgt
aacataatagaagctaactttgatgaaagcaccggccaatgtagtgacgtacagattccaacggtaagcgttattaccgtagtggtgggca
agctaactttaatgtagcaggcgatcatgctgctgcaattcatgttggcgcaaaaattggtgatcaatgtagtggtgatgattgccatgtacagga
tcgattgtaataatgatcctaaccctgattttgcagtagcagcaacatcaattgtacatcagaaaaattacctacgctatattactggggagcaca
gcctacagatagcttagcgaatgcagcttggccaggtgtgcgaatgcaaaacaaatggcgacttaagtgtcatgatttaggtgtcgaactaacca
aaattaacgccatcttttagtgacaatggtgcaataaaaacagctgatctaactgttactggtgcaggtgttataaagacgggacttggagcacctt
acaaaattgtggtttgaaattaccggtgcacaaaccaatccagtcggtggcgacgaagctggtacttccgaggtactgtaatactggtgggta
aagcacaattagattatgacgcaactagcgggtttgattacacaatacaaaagcttaattggtgaagaagcacctgcgcgttttaaaattgataatggt
agttggactgaagcttatccaacagctgattaccaaggttacagataacaattcataccgcaattaacttaatagcgatagcaaaagcattacagtaa
acgcacaataa

SEQ ID NO: 102

Met Arg Phe Phe Pro Lys Leu Ile Ser Pro Phe Pro Gln Asn Thr Arg Glu Trp Gln Arg Ser Ala Val
Ser Arg Asp Thr Glu Gln Leu Gln Arg Lys Val Ile Met Ile Asn Leu Lys Lys Asn Thr Ile Ser Ala
Leu Val Ala Gly Met Val Leu Gly Phe Ala Ser Asn Ala Met Ala Val Pro Arg Thr Ala Phe Val His
Leu Phe Glu Trp Lys Trp Glu Asp Val Ala Gln Glu Cys Glu Thr Phe Leu Gly Pro Lys Gly Phe Ala
Ala Val Gln Val Ser Pro Pro Thr Lys Ser His Asn Thr Asp Ala Trp Trp Gly Arg Tyr Gln Pro Val
Ser Tyr Ala Phe Glu Gly Arg Ser Gly Asn Arg Ser Gln Phe Lys Asn Met Val Gln Arg Cys Lys Ala
Val Gly Val Asp Ile Tyr Val Asp Ala Val Ile Asn His Met Ala Ala Tyr Asp Arg Asn Phe Pro Asp
Val Pro Tyr Ser Ser Asn Asp Phe Asn Ser Cys Thr Gly Asp Ile Asp Tyr Asn Asn Arg Trp Gln Thr
Gln His Cys Asp Leu Val Gly Leu Asn Asp Leu Lys Thr Gly Ser Asp Tyr Val Arg Gln Lys Ile Ala
Asp Tyr Met Asn Asp Ala Ile Ser Met Gly Val Ala Gly Phe Arg Ile Asp Ala Ala Lys His Ile Pro
Ala Gly Asp Ile Ala Ala Ile Lys Gly Lys Leu Asn Gly Asn Pro Tyr Ile Phe Gln Glu Val Ile Gly Ala
Ser Gly Glu Pro Val Arg Pro Thr Glu Tyr Thr Phe Ile Gly Gly Val Thr Glu Phe Gln Phe Ala Arg
Lys Leu Gly Pro Ala Phe Arg Asn Ser Asn Ile Ala Trp Leu Lys Asp Ile Gly Ser Gln Met Glu Leu
Ser Ser Ala Asp Ala Val Thr Phe Val Thr Asn His Asp Glu Glu Arg His Asn Pro Asn Gly Pro Ile
Trp His Gly Val Gln Gly Asn Gly Tyr Ala Leu Ala Asn Ile Phe Thr Leu Ala Tyr Pro Tyr Gly Tyr
Pro Lys Ile Met Ser Gly Tyr Phe Phe His Gly Asp Phe Asn Ala Ala Pro Pro Ser Ser Gly Ile His Thr

Figure 16MM



Gly Asn Ala Cys Gly Phe Asp Gly Gly Asp Trp Val Cys Glu His Lys Trp Arg Gly Ile Ala Asn Met
Val Ala Phe Arg Asn Tyr Thr Ala Ser Glu Trp Arg Ile Ser Asn Trp Trp Gln Asn Ser Asn Asp Gln
Ile Ala Phe Gly Arg Gly Gly Leu Gly Phe Val Val Ile Asn Lys Arg Ala Asn Gly Ser Ile Asn Gln
Ser Phe Asp Thr Gly Met Pro Asp Gly Gln Tyr Cys Asn Ile Ile Glu Ala Asn Phe Asp Glu Ser Thr
Gly Gln Cys Ser Ala Ala Thr Asp Ser Asn Gly Gln Ala Val Ile Thr Val Ser Gly Gly Gln Ala Asn
Phe Asn Val Ala Gly Asp His Ala Ala Ala Ile His Val Gly Ala Lys Ile Gly Asp Gln Cys Ser Gly
Asp Asp Cys Pro Cys Thr Gly Ser Asp Cys Asn Asn Asp Pro Lys Pro Asp Phe Ala Val Pro Ala
Thr Ser Ile Cys Thr Ser Glu Asn Leu Pro Thr Leu Tyr Tyr Trp Gly Ala Gln Pro Thr Asp Ser Leu
Ala Asn Ala Ala Trp Pro Gly Val Ala Met Gln Thr Asn Gly Asp Phe Lys Cys His Asp Leu Gly Val
Glu Leu Thr Lys Ile Asn Ala Ile Phe Ser Asp Asn Gly Ala Asn Lys Thr Ala Asp Leu Thr Val Thr
Gly Ala Gly Cys Tyr Lys Asp Gly Thr Trp Ser Thr Leu Gln Asn Cys Gly Phe Glu Ile Thr Gly Ala
Gln Thr Asn Pro Val Gly Gly Asp Glu Val Trp Tyr Phe Arg Gly Thr Ala Asn Asp Trp Gly Lys Ala
Gln Leu Asp Tyr Asp Ala Thr Ser Gly Leu Tyr Tyr Thr Ile Gln Ser Phe Asn Gly Glu Glu Ala Pro
Ala Arg Phe Lys Ile Asp Asn Gly Ser Trp Thr Glu Ala Tyr Pro Thr Ala Asp Tyr Gln Val Thr Asp
Asn Asn Ser Tyr Arg Ile Asn Phe Asn Ser Asp Ser Lys Ala Ile Thr Val Asn Ala Gln

SEQ ID NO: 103

gtgctaacgtttaccgcatcattcgaaaaggatggatgttctgctcgcgttttctcactgcctcgtgttctgcccacaggacagcccgcc
aggctgccgcaccgtttaacggcaccatgatgcagttatggaatggtacttgcggatgatggcagttatggaccaaaagtgccaatgaagc
caacaactatccagccttggcatcaccgctcttggctgccgccgcttacaaaggaacaagccgcagcgacgtagggtacggagtatacga
cttgatgacctggcgaaattcaatcaaaaaggaccgtccgcacaaaatacgaacaaaagctcaatatctcaagccattcaagccgccac
gccgctggaatgcaagtgtacgccgatgtcgtgttcgaccataaaggcgccgacggcaggaatgggtggacgccgtcgaagtcaatc
cgtccgaccgcaaccaagaatctcgggcacatatcaaatcaagcatggacgaaattgattttccggggcggggaacacactactccagctt
taagtggcgctggtaccattttgacggcgttgattgggacgaaagccgaaaattgagccgcattacaaattccgggcacatggcaaaagcgtgg
gattgggaagtagacacggaaaacggaaactatgactactaatgtatgccaccttgatgatgatcccgaaagtcgtgaccgagctgaaaa
actgggggggaatggtatgtcaacacaacgaacattgatgggttccggttgatgccgtcaagcatattaagttcagtttttttctgattggttgcgt
atgtgcgttctcagactggcaagccgctattaccgtcgggggaatattggagctatgacatcaacaagttgcacaattacattacgaaaacaaacg
gaacgatgtctttgttgatgccccgttacacaacaaatattataccggttccaaatcagggggcgcatgtgatgcgcaggttaattgaccaatact
ctcatgaaagatcaaccgacattggccgctaccttcgttgataatcatgacaccgaaccggccaagcgtcgcagtcagtcagtcagtcagtcagtc
tcaaacgggttggttacgctttatttctaactcggcaggaaggatacccgctgcgtctttatggtgactattatggcattccacaataataacattccttc
gctgaaaagcaaaatcgatccgctcctcatcgcgcgagggattatgcttacggaacgcaacatgattatcttgatcactccgacatcatcggtg
ggacaaggggaaggggtcactgaaaaaccaggatccgggctggccgactgatcaccgatgggcccgggaggaagcaaatggatgtacgttg
gcaaacacacgctggaaaagtgttctatgacctaccggcaaccggagtgacaccgtcaccatcaacagtgatggatgggggggaattcaaa
gtcaatggcggttcggttgcgttgggttcctagaaaaacgaccgtttctaccatcgctcggccgatcacaacccgaccgtggactggtgaattc
gtccgttggaccgaaccacggttgggtgcatggccttga

SEQ ID NO: 104

Val Leu Thr Phe His Arg Ile Ile Arg Lys Gly Trp Met Phe Leu Leu Ala Phe Leu Leu Thr Ala Ser
Leu Phe Cys Pro Thr Gly Gln Pro Ala Lys Ala Ala Ala Pro Phe Asn Gly Thr Met Met Gln Tyr Phe
Glu Trp Tyr Leu Pro Asp Asp Gly Thr Leu Trp Thr Lys Val Ala Asn Glu Ala Asn Asn Leu Ser Ser
Leu Gly Ile Thr Ala Leu Trp Leu Pro Pro Ala Tyr Lys Gly Thr Ser Arg Ser Asp Val Gly Tyr Gly
Val Tyr Asp Leu Tyr Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr
Lys Ala Gln Tyr Leu Gln Ala Ile Gln Ala Ala His Ala Ala Gly Met Gln Val Tyr Ala Asp Val Val
Phe Asp His Lys Gly Gly Ala Asp Gly Thr Glu Trp Val Asp Ala Val Glu Val Asn Pro Ser Asp Arg
Asn Gln Glu Ile Ser Gly Thr Tyr Gln Ile Gln Ala Trp Thr Lys Phe Asp Phe Pro Gly Arg Gly Asn
Thr Tyr Ser Ser Phe Lys Trp Arg Trp Tyr His Phe Asp Gly Val Asp Trp Asp Glu Ser Arg Lys Leu
Ser Arg Ile Tyr Lys Phe Arg Gly Ile Gly Lys Ala Trp Asp Trp Glu Val Asp Thr Glu Asn Gly Asn
Tyr Asp Tyr Leu Met Tyr Ala Asp Leu Asp Met Asp His Pro Glu Val Val Thr Glu Leu Lys Asn
Trp Gly Glu Trp Tyr Val Asn Thr Thr Asn Ile Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Lys
Phe Ser Phe Phe Pro Asp Trp Leu Ser Tyr Val Arg Ser Gln Thr Gly Lys Pro Leu Phe Thr Val Gly



Figure 16NN

Glu Tyr Trp Ser Tyr Asp Ile Asn Lys Leu His Asn Tyr Ile Thr Lys Thr Asn Gly Thr Met Ser Leu
Phe Asp Ala Pro Leu His Asn Lys Phe Tyr Thr Ala Ser Lys Ser Gly Gly Ala Phe Asp Met Arg Thr
Leu Met Thr Asn Thr Leu Met Lys Asp Gln Pro Thr Leu Ala Val Thr Phe Val Asp Asn His Asp
Thr Glu Pro Gly Gln Ala Leu Gln Ser Trp Val Asp Pro Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile
Leu Thr Arg Gln Glu Gly Tyr Pro Cys Val Phe Tyr Gly Asp Tyr Tyr Gly Ile Pro Gln Tyr Asn Ile
Pro Ser Leu Lys Ser Lys Ile Asp Pro Leu Leu Ile Ala Arg Arg Asp Tyr Ala Tyr Gly Thr Gln His
Asp Tyr Leu Asp His Ser Asp Ile Ile Gly Trp Thr Arg Glu Gly Val Thr Glu Lys Pro Gly Ser Gly
Leu Ala Ala Leu Ile Thr Asp Gly Pro Gly Gly Ser Lys Trp Met Tyr Val Gly Lys Gln His Ala Gly
Lys Val Phe Tyr Asp Leu Thr Gly Asn Arg Ser Asp Thr Val Thr Ile Asn Ser Asp Gly Trp Gly Glu
Phe Lys Val Asn Gly Gly Ser Val Ser Val Trp Val Pro Arg Lys Thr Thr Val Ser Thr Ile Ala Arg
Pro Ile Thr Thr Arg Pro Trp Thr Gly Glu Phe Val Arg Trp Thr Glu Pro Arg Leu Val Ala Trp Pro

SEQ ID NO: 105

atgtccctattcaaaaaatcttccgtggattgtatctacttcttttgttttcgtttattgctccttttccattcaaacagaaaaagtcgcgctggaa
gtgttccagtgaatggaacgatgatgaatatttccgaatggtaccttccagacgatggaacactatggacgaaagtagcaaataacgccaatct
ttagcgaatcttggcattactgcccttggcttccccctgcctataaaggaacaaagcagcagtgacgttgatattggcgtttatgatttatgacct
aggagagttaatacaaaaaggaaactgtccgaacaaaatacggaaacaaaacacaatatccaagcaatccaagcggcgcatacagcaggaa
tgcaagtatatgcagatgtcgtctttaaccataaagccggtgcagatgggacagaactagtggtatgcagtagaagtaaaccctctgaccgcaat
caagaaatatcaggaacatatcaaatccaagcgtggacaaaatttgatttctggtcgtggaaacacctattctagttaaatggcgttggtatca
tttcgatggaacggactgggatgagagtagaaaactaaatcgtatttacaattccgcggcacgggaaaagcatgggattgggaagtatagataca
gaaaatgggaattatgactatctcatgtatgcagatttggatatggatcatccagaggttgatctgaactaaaaaattggggaaaagtggatgtaa
ccacaaccaatcgcagggattccgtctggatgcagtgaagcatattaaatatagtcttttccagactggctatcgtatgtacgaacccaaacac
aaaagcctcttttggcgttggcgaattttggagctatgacattaacaagctacacaactatattacaagacgaacggctctatgtccctattcgt
gccccgtgcataacaatttttatatagcatcgaatcaggtggctattttgatatgcgcacattactcaacaacacattgatgaaagatcaaccaa
cactatcggtcacattagtagacaatcacgatactgagccagggaacatctttgcagtcgtgggtcagccgtggttaaacctgttagcttacgcat
ttatcttgaaccgccaagaaggttatccgtgcattttatggagattactatggtattccaaaatacaacattcctgcgtgaaaagcaaaactgatc
cgctgttaattgctcgaagagattatgcctacggaacacagcagcactatattgacaatgcagatattatcggctggacgcgggaaggagtagct
gaaaaagcaaatcgggactgtcgcactaccgacggacctggcgggaagcaaatggatgtatgttggcaacaacacgctggcaaaaac
gttttatgatctaaccggcaatcgaagtatacagtgacaatcaacgctgatggatggggagaatttaagtaatggagggtctgtatccatag
ggttccaaaaacatcaaccacttcccaaatcacattactgtaataatgccacaaccgtttggggacaaaatgtatcagttgtcgggaatatttcg
cagctgggcaac

SEQ ID NO: 106

Met Ser Leu Phe Lys Lys Ile Phe Pro Trp Ile Val Ser Leu Leu Leu Leu Phe Ser Phe Ile Ala Pro Phe
Ser Ile Gln Thr Glu Lys Val Arg Ala Gly Ser Val Pro Val Asn Gly Thr Met Met Gln Tyr Phe Glu
Trp Tyr Leu Pro Asp Asp Gly Thr Leu Trp Thr Lys Val Ala Asn Asn Ala Gln Ser Leu Ala Asn Leu
Gly Ile Thr Ala Leu Trp Leu Pro Pro Ala Tyr Lys Gly Thr Ser Ser Ser Asp Val Gly Tyr Gly Val
Tyr Asp Leu Tyr Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr Lys
Thr Gln Tyr Ile Gln Ala Ile Gln Ala Ala His Thr Ala Gly Met Gln Val Tyr Ala Asp Val Val Phe
Asn His Lys Ala Gly Ala Asp Gly Thr Glu Leu Val Asp Ala Val Glu Val Asn Pro Ser Asp Arg Asn
Gln Glu Ile Ser Gly Thr Tyr Gln Ala Trp Thr Lys Phe Asp Phe Pro Gly Arg Gly Asn Thr
Tyr Ser Ser Phe Lys Trp Arg Trp Tyr His Phe Asp Gly Thr Asp Trp Asp Glu Ser Arg Lys Leu Asn
Arg Ile Tyr Lys Phe Arg Gly Thr Gly Lys Ala Trp Asp Trp Glu Val Asp Thr Glu Asn Gly Asn Tyr
Asp Tyr Leu Met Tyr Ala Asp Leu Asp Met Asp His Pro Glu Val Val Ser Glu Leu Lys Asn Trp
Gly Lys Trp Tyr Val Thr Thr Thr Asn Ile Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Lys Tyr
Ser Phe Phe Pro Asp Trp Leu Ser Tyr Val Arg Thr Gln Thr Gln Lys Pro Leu Phe Ala Val Gly Glu
Phe Trp Ser Tyr Asp Ile Asn Lys Leu His Asn Tyr Ile Thr Lys Thr Asn Gly Ser Met Ser Leu Phe
Asp Ala Pro Leu His Asn Asn Phe Tyr Ile Ala Ser Lys Ser Gly Gly Tyr Phe Asp Met Arg Thr Leu
Leu Asn Asn Thr Leu Met Lys Asp Gln Pro Thr Leu Ser Val Thr Leu Val Asp Asn His Asp Thr



Figure 1600

Glu Pro Gly Gln Ser Leu Gln Ser Trp Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu
Thr Arg Gln Glu Gly Tyr Pro Cys Ile Phe Tyr Gly Asp Tyr Tyr Gly Ile Pro Lys Tyr Asn Ile Pro
Ala Leu Lys Ser Lys Leu Asp Pro Leu Leu Ile Ala Arg Arg Asp Tyr Ala Tyr Gly Thr Gln His Asp
Tyr Ile Asp Asn Ala Asp Ile Ile Gly Trp Thr Arg Glu Gly Val Ala Glu Lys Ala Asn Ser Gly Leu
Ala Ala Leu Ile Thr Asp Gly Pro Gly Gly Ser Lys Trp Met Tyr Val Gly Lys Gln His Ala Gly Lys
Thr Phe Tyr Asp Leu Thr Gly Asn Arg Ser Asp Thr Val Thr Ile Asn Ala Asp Gly Trp Gly Glu Phe
Lys Val Asn Gly Gly Ser Val Ser Ile Trp Val Pro Lys Thr Ser Thr Thr Ser Gln Ile Thr Phe Thr Val
Asn Asn Ala Thr Thr Val Trp Gly Gln Asn Val Tyr Val Val Gly Asn Ile Ser Gln Leu Gly Asn

SEQ ID NO: 107

atggacagcctcgacgcgccggagcagaagccctgggtgaaggatggcaggctctccgctacctggatacagggacagggaccgtggtc
gctcccaggacacctgcgccccgccgccccggccgaggaagtcggcccgctggacaagtggaaaaacgatatcatctattcgtcctcac
cgaccgtttccaggatggcgacaagaccaacaacatggacgtggtcccgcggacatgaaaaaatatcatggcggcgacatccaggggctc
atcgacaagctcgactatatcaaggagaccggttcgacggccatctggctcacgccccctatgaaggggcagaccactcttcgagaccgac
aattaccatggttactggccattgacttctatgacacggacccccatgtgggcaccatgcagaaattgaggagcttatcgagaagcccatga
gaaagggctgaagatcgtgctcgatattccctgaaccacacggcctgggagcatccctctacaaggacgacagcaagaaggactggttcc
accatataggagatgtgaaggactgggaagatccctactgggctgaaaacggctccatattcggtcttcctgacctggcgaggaacccctg
ccgtggaaaagtacatcgacgtggccaagtctgggtgtagacaagggtattgacggcttcaggcttgacgccgtgaagaacgtgccccca
acttctggggaagtttgaccgggcatcagattatcggggcaaggacttctcctcgtcggggaatacttgacggaaacccggcgaaagt
cgcgaaactaccagagagaggacatgagctcactcttcgattaccgcctactggacccctgaaggacaccttcgccaaggacgggagcatgc
gcaacctggcgccgaagcttgatgagtgacaggaattatcccgacccgggcccctatgctcggtttcttgataaccacgacacgccgaggtt
cctcaccgagggccaacggcaacaaggataagctcaaacctggccctgccttcgcgatgaccatcaaccgcatgcctaccattattatggcacc
gaggttgccatggaaggcaactgcgatcatggcgccgtagataaccggaggacatgcagtgaggacaaggatcctgacatgttcaata
ctcaagactctaccactgcccgaatgagcatgaatccctcagggaaggaaagaagctcgagatgtggcaggatgacaaagtctacgcgta
cgggagggcagaccccgaaggacgagctatcgtggtgcttaacaacggctatgatacgaggaacgggacataccgctccgccccgagag
cgcatcaagaacggcacggtgctgaaggatgtcatccggcgaaacctgacggtacagaacggaaaaatccatgcgaatgcggcgg
caaacaggcgcggtatctacgtgccgcgtag

SEQ ID NO: 108

Met Asp Ser Leu Asp Ala Pro Glu Gln Lys Pro Trp Val Lys Asp Gly Arg Leu Ser Ala Tyr Leu Asp
Thr Gly Thr Gly Thr Val Val Ala Pro Glu Ala Pro Ala Pro Pro Pro Ala Glu Glu Val Arg
Pro Val Asp Lys Trp Lys Asn Asp Ile Ile Tyr Phe Val Leu Thr Asp Arg Phe Gln Asp Gly Asp Lys
Thr Asn Asn Met Asp Val Val Pro Thr Asp Met Lys Lys Tyr His Gly Gly Asp Ile Gln Gly Leu Ile
Asp Lys Leu Asp Tyr Ile Lys Glu Thr Gly Ser Thr Ala Ile Trp Leu Thr Pro Pro Met Lys Gly Gln
Thr His Phe Phe Glu Thr Asp Asn Tyr His Gly Tyr Trp Pro Ile Asp Phe Tyr Asp Thr Asp Pro His
Val Gly Thr Met Gln Lys Phe Glu Glu Leu Ile Glu Lys Ala His Glu Lys Gly Leu Lys Ile Val Leu
Asp Ile Pro Leu Asn His Thr Ala Trp Glu His Pro Phe Tyr Lys Asp Asp Ser Lys Lys Asp Trp Phe
His His Ile Gly Asp Val Lys Asp Trp Glu Asp Pro Tyr Trp Ala Glu Asn Gly Ser Ile Phe Gly Leu
Pro Asp Leu Ala Gln Glu Asn Pro Ala Val Glu Lys Tyr Leu Ile Asp Val Ala Lys Phe Trp Val Asp
Lys Gly Ile Asp Gly Phe Arg Leu Asp Ala Val Lys Asn Val Pro Leu Asn Phe Trp Ala Lys Phe Asp
Arg Ala Ile His Asp Tyr Ala Gly Lys Asp Phe Leu Leu Val Gly Glu Tyr Phe Asp Gly Asn Pro Ala
Lys Val Ala Asn Tyr Gln Arg Glu Asp Met Ser Ser Leu Phe Asp Tyr Pro Leu Tyr Trp Thr Leu Lys
Asp Thr Phe Ala Lys Asp Gly Ser Met Arg Asn Leu Ala Ala Lys Leu Asp Glu Cys Asp Arg Asn
Tyr Pro Asp Pro Gly Leu Met Ser Val Phe Leu Asp Asn His Asp Thr Pro Arg Phe Leu Thr Glu Ala
Asn Gly Asn Lys Asp Lys Leu Lys Leu Ala Leu Ala Phe Ala Met Thr Ile Asn Arg Met Pro Thr Ile
Tyr Tyr Gly Thr Glu Val Ala Met Glu Gly Asn Cys Asp Ile Met Gly Ala Val Asp Asn Arg Arg
Asp Met Gln Trp Asp Lys Asp Pro Asp Met Phe Lys Tyr Phe Lys Thr Leu Thr Thr Ala Arg Asn
Glu His Glu Ser Leu Arg Glu Gly Lys Lys Leu Glu Met Trp Gln Asp Asp Lys Val Tyr Ala Tyr Gly
Arg Gln Thr Pro Lys Asp Glu Ser Ile Val Val Leu Asn Asn Gly Tyr Asp Thr Gln Glu Arg Asp Ile

Figure 16PP



Pro Leu Arg Pro Glu Ser Gly Ile Lys Asn Gly Thr Val Leu Lys Asp Val Ile Thr Gly Glu Thr Val
Thr Val Gln Asn Gly Lys Ile His Ala Lys Cys Gly Gly Lys Gln Ala Arg Ile Tyr Val Pro Ala

SEQ ID NO: 109

atggcaagaaaacgctggccataatcttctgacttctagtgtctttagtctctcggcagttccggcaaggcagaaactctagagaatggtgga
gttataatgcaggctttctattgggatgttctggaggaggaatctgtgtggacacaatagctcaaaagatacccgatgggcaagtcaggaat
ctcagcgatatggattccaccagcgagtaagggcatgagcgggtgttattccatgggtacgatccctacgatttcttgacctggcgagtacta
tcagaaggggacagttgagacgcgttcgggtcaaaggaagaactgtgaacatgataaacaccgcacactcctacggcataaagggtgatag
cggacatagtcataaaccaccgcgccgggtggagaccttgagtgaaccccttcgtgaacgactatactggacagacttctcaaaagtcgcctc
cggtaaatatatacggccaactaccttgacttccacccaacgagcttactgttgatgaaggtaccttggaggataccctgatatagtcacga
caaaagctgggaccagtactggctctgggcgagcagcgaaagctacgtgcctacctcaggagcataggggttgacgcctggcggttgcact
acgtcaagggtacggagcatgggtgttaacgactggctcagctgggtggggaggctgggcccgttgagagtactgggacagcaacgttgat
gactcctcaactgggcatacagcagcgccgcaaggtcttgacttcccgtctactacaagatggacgaagccttcgacaacaccaacatcc
cggcattagtggatgcactcagatacggccagacagtggtcagccgcgatccctcaaggcggttaacttctgttccaaccacgatacagatat
aatctggaacaagtatccggcttatgcattcactcctacatgagggacagcctgttatattctaccgcgactacgaggagtggctcaacaagga
taagcttaacaacctcatctggatacacgataccttgcctggaggagtagctgacattgtttactacgacagcgacgagcttatcttggagaac
ggctatggcaccaaacaggactgataacctatacaacctcggctcaagcaaaagtggaaggtgggtctacgttccaaagtcgccgggtcat
gcatccacgagtacaccggcaacctcggcggttgatagacaagtacgtctcctccagcggtgggtctatcttgaggccccagcccagac
ccggcgcaacggctactacggctactctgtctggagctactgcgggtgtgggttga

SEQ ID NO: 110

Met Ala Arg Lys Thr Leu Ala Ile Phe Phe Val Leu Leu Val Leu Leu Ser Leu Ser Ala Val Pro Ala
Lys Ala Glu Thr Leu Glu Asn Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Gly Gly Gly
Ile Trp Trp Asp Thr Ile Ala Gln Lys Ile Pro Glu Trp Ala Ser Ala Gly Ile Ser Ala Ile Trp Ile Pro Pro
Ala Ser Lys Gly Met Ser Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp Leu Gly Glu
Tyr Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Glu Glu Leu Val Asn Met Ile Asn Thr
Ala His Ser Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp Leu Glu Trp
Asn Pro Phe Val Asn Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr Thr Ala Asn
Tyr Leu Asp Phe His Pro Asn Glu Leu His Cys Cys Asp Glu Gly Thr Phe Gly Gly Tyr Pro Asp Ile
Cys His Asp Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Ser Glu Ser Tyr Ala Ala Tyr Leu Arg
Ser Ile Gly Val Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp Val Val Asn Asp Trp
Leu Ser Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala Leu Leu Asn Trp
Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Glu Ala Phe Asp Asn
Thr Asn Ile Pro Ala Leu Val Asp Ala Leu Arg Tyr Gly Gln Thr Val Val Ser Arg Asp Pro Phe Lys
Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala Tyr Ala Phe Ile
Leu Thr Tyr Glu Gly Gln Pro Val Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn Lys Asp Lys Leu
Asn Asn Leu Ile Trp Ile His Asp His Leu Ala Gly Gly Ser Thr Asp Ile Val Tyr Tyr Asp Ser Asp
Glu Leu Ile Phe Val Arg Asn Gly Tyr Gly Thr Lys Pro Gly Leu Ile Thr Tyr Ile Asn Leu Gly Ser
Ser Lys Val Gly Arg Trp Val Tyr Val Pro Lys Phe Ala Gly Ser Cys Ile His Glu Tyr Thr Gly Asn
Leu Gly Gly Trp Ile Asp Lys Tyr Val Ser Ser Ser Gly Trp Val Tyr Leu Glu Ala Pro Ala His Asp
Pro Ala Asn Gly Tyr Tyr Gly Tyr Ser Val Trp Ser Tyr Cys Val Gly

SEQ ID NO: 111

atgcccgcgttcaaatctaaggatgacatgaagtggaagtaccttgccttagtttggctgtggcttcgataggcctcctcgcactccagt
gggtgctgccaaagtactccgaactcgaagaggcggtgtataatgcaggccttctactgggacgtccctaccgggtgggatctggtgggacac
cataagacagaaaatcccggagtgtgtacgacgctggaatctcggcgatattgattctccagctagcaaaaggtatgggtggtgcatactccatg
ggttatgaccttacgatttcttgacctggcgagtactatcagaagggaacagttgagacgcgttcgggtcaaaggagggaactggtgaaca
tgataaacaccgcacactcctatggcataaaggatgatacggacatagtcataaaccaccgcgccggcgccgacctggagtgaaccccttg
taaacactatacttgacagacttctcaaggtcgctccggtaatacacggccaactaccttgacttccacccaacgaggtcaagtgctgc
gatgagggtacatttggtagcttccggacatcgccacgagaagagctgggatcagtactggctctgggcaagcaatgagagctacgccgcc

Figure 16QQ



tatctccggagcatagggatcgatgcattgcttgcactacgtcaaaggttacggagcgtgggtgttaacgactggctcagctgggtggggag
gttgggcccgttgagagtagtgggacaccaacgttgatgcactccttaactgggcatacaacagcgggtccaaggctttgacttcccgtctac
tacaagatggacgaagccttgacaacaccaacatccccgctttggtttacgcccctcagaacggaggaacagtcgttcccgcatccctcaa
ggcagtaactttcgttccaaccacgataccgataataatctggaacaagtatccgcttatgcgttcatcttacctatgagggacagcctgttat
tctaccgcgactacgaggagtggctcaacaaggataagcttaacaaccttatctggatacacgagcaccttgcggagggaagtaccaagatcct
ctactacgataacgatgagctaataattcatgagggaggggctacgggagcagccgggctcataacctacataaacctcgaaacgactggg
ccgagcgttgggtgaacgtcggtcaaagtttgcgggtacacaatccatgaatacacaggcaatctcggtggctgggttgacaggtgggttc
agtacgacggatgggttaaactgacggcacctcctcacgatccagccaacggatattacggctactcagcttgagctacgagcgctcgat
ga

SEQ ID NO: 112

Met Pro Ala Phe Lys Ser Lys Val Met His Met Lys Leu Lys Tyr Leu Ala Leu Val Leu Leu Ala Val
Ala Ser Ile Gly Leu Leu Ser Thr Pro Val Gly Ala Ala Lys Tyr Ser Glu Leu Glu Glu Gly Gly Val Ile
Met Gln Ala Phe Tyr Trp Asp Val Pro Thr Gly Gly Ile Trp Trp Asp Thr Ile Arg Gln Lys Ile Pro
Glu Trp Tyr Asp Ala Gly Ile Ser Ala Ile Trp Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser
Met Gly Tyr Asp Pro Tyr Asp Phe Phe Asp Leu Gly Glu Tyr Tyr Gln Lys Gly Thr Val Glu Thr
Arg Phe Gly Ser Lys Glu Glu Leu Val Asn Met Ile Asn Thr Ala His Ser Tyr Gly Ile Lys Val Ile
Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp Leu Glu Trp Asn Pro Phe Val Asn Asn Tyr Thr
Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu
Val Lys Cys Cys Asp Glu Gly Thr Phe Gly Asp Phe Pro Asp Ile Ala His Glu Lys Ser Trp Asp Gln
Tyr Trp Leu Trp Ala Ser Asn Glu Ser Tyr Ala Ala Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg
Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp Val Val Asn Asp Trp Leu Ser Trp Trp Gly Gly Trp Ala
Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala Leu Leu Asn Trp Ala Tyr Asn Ser Gly Ala Lys Val
Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Glu Ala Phe Asp Asn Thr Asn Ile Pro Ala Leu Val Tyr
Ala Leu Gln Asn Gly Gly Thr Val Val Ser Arg Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His
Asp Thr Asp Ile Ile Trp Asn Lys Tyr Pro Ala Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Val Ile
Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn Lys Asp Lys Leu Asn Asn Leu Ile Trp Ile His Glu His
Leu Ala Gly Gly Ser Thr Lys Ile Leu Tyr Tyr Asp Asn Asp Glu Leu Ile Phe Met Arg Glu Gly Tyr
Gly Ser Lys Pro Gly Leu Ile Thr Tyr Ile Asn Leu Gly Asn Asp Trp Ala Glu Arg Trp Val Asn Val
Gly Ser Lys Phe Ala Gly Tyr Thr Ile His Glu Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Arg Trp
Val Gln Tyr Asp Gly Trp Val Lys Leu Thr Ala Pro Pro His Asp Pro Ala Asn Gly Tyr Tyr Gly Tyr
Ser Val Trp Ser Tyr Ala Gly Val Gly

SEQ ID NO: 113

atgaaacaacaaaacggctttacgcccattgctgacgctgttatttgcgctcatcttcttctgctgcctcattctgcagcagcggcggaacattta
atgggacgctgatgcagtagtttgaatggtacatgcccaatgacggccaacattggaagcgttgcaaacgactcggcatatttggctgaacac
ggtattactgctgctgattccccggcatataagggaacgagccaagcggatgtgggctacgggtgcttacgaccttatgatttaggggagttt
catcaaaaaggacggttcggacaaagtacggcacaaaaggagagctgcaatctgcgatcaaaaagtcttattcccgacattaacgtttacg
gggatgtggtcatcaaccacaaaggcggcgctgatgcgaccgaagatgaaccgcggtgaagtcgatcccgctgaccgcaaccgcgtaatt
tcaggagaacaccgaattaaagcctggacacattttcatttccggggcgggcagcacatacagcgattttaaattggcatttggtaccattttgac
ggaaccgattgggacgagtcgggaaagctgaaccgcactctataagttcaaggaaaggcttgggattgggaagtttccaatgaaaacggcaac
tatgattatttgatgatgccgacatcgattatgaccatcctgatgtcgcagcagaaattaagagatggggcacttggtatgccaatgaactgcaatt
ggacgggttccgtctgatgtgtcaaacacattaaatttttcttttgcgggattgggttaatcatgtcagggaaaaaacggggaaggaaatgttta
cggtagctgaatttggcagaatgacttggcgcgctggaaaactatttgaacaaaacaaatttattcattcagtggttgacgtgccgttcattat
cagttccatgctgacacagggaggcggtatgatagaggaaattgctgaacggtagcgttcgttccaagcatccggttgaaagcggtta
catttgcgataaccatgatacacagccggggcaatcgcttgatgcgactgtccaaacatggtttaaagcgttgcttacgcttctcacaag
ggaatctgataccctcaggtttttctacggggatgtacgggacgaaaggagactccagcgcgaaattcctgccttgaaacacaaaattgaa
ccgatcttaaaagcgagaaaacagtagtgcgtacggagcacagcatgattttcgaccaccatgacattgtcggttgacaagggaaggcgac
agctcgggtgcaaatcaggtttggcgggcatttaaacagacggaccgggtggggcgaagcgaatgtatgtcggccggcaaacgccgggtga

Figure 16RR



gacatggcatgacattaccggaaccgttcggagccggtgtcatcaattcgaaggctggggagagtttcacgtaaaccggcgggtcgggttc
atttatgttcaaatagatag

SEQ ID NO: 114

Met Lys Gln Gln Lys Arg Leu Tyr Ala Arg Leu Leu Thr Leu Leu Phe Ala Leu Ile Phe Leu Leu Pro
His Ser Ala Ala Ala Ala Asn Leu Asn Gly Thr Leu Met Gln Tyr Phe Glu Trp Tyr Met Pro Asn
Asp Gly Gln His Trp Lys Arg Leu Gln Asn Asp Ser Ala Tyr Leu Ala Glu His Gly Ile Thr Ala Val
Trp Ile Pro Pro Ala Tyr Lys Gly Thr Ser Gln Ala Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr Asp
Leu Gly Glu Phe His Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr Lys Gly Glu Leu Gln Ser Ala
Ile Lys Ser Leu His Ser Arg Asp Ile Asn Val Tyr Gly Asp Val Val Ile Asn His Lys Gly Gly Ala
Asp Ala Thr Glu Asp Val Thr Ala Val Glu Val Asp Pro Ala Asp Arg Asn Arg Val Ile Ser Gly Glu
His Arg Ile Lys Ala Trp Thr His Phe His Phe Pro Gly Arg Gly Ser Thr Tyr Ser Asp Phe Lys Trp
His Trp Tyr His Phe Asp Gly Thr Asp Trp Asp Glu Ser Arg Lys Leu Asn Arg Ile Tyr Lys Phe Gln
Gly Lys Ala Trp Asp Trp Glu Val Ser Asn Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Ile
Asp Tyr Asp His Pro Asp Val Ala Ala Glu Ile Lys Arg Trp Gly Thr Trp Tyr Ala Asn Glu Leu Gln
Leu Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Lys Phe Ser Phe Leu Arg Asp Trp Val Asn His
Val Arg Glu Lys Thr Gly Lys Glu Met Phe Thr Val Ala Glu Tyr Trp Gln Asn Asp Leu Gly Ala
Leu Glu Asn Tyr Leu Asn Lys Thr Asn Phe Asn His Ser Val Phe Asp Val Pro Leu His Tyr Gln Phe
His Ala Ala Ser Thr Gln Gly Gly Gly Tyr Asp Met Arg Lys Leu Leu Asn Gly Thr Val Val Ser Lys
His Pro Leu Lys Ala Val Thr Phe Val Asp Asn His Asp Thr Gln Pro Gly Gln Ser Leu Glu Ser Thr
Val Gln Thr Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu Thr Arg Glu Ser Gly Tyr Pro Gln Val
Phe Tyr Gly Asp Met Tyr Gly Thr Lys Gly Asp Ser Gln Arg Glu Ile Pro Ala Leu Lys His Lys Ile
Glu Pro Ile Leu Lys Ala Arg Lys Gln Tyr Ala Tyr Gly Ala Gln His Asp Tyr Phe Asp His His Asp
Ile Val Gly Trp Thr Arg Glu Gly Asp Ser Ser Val Ala Asn Ser Gly Leu Ala Ala Leu Ile Thr Asp
Gly Pro Gly Gly Ala Lys Arg Met Tyr Val Gly Arg Gln Asn Ala Gly Glu Thr Trp His Asp Ile Thr
Gly Asn Arg Ser Glu Pro Val Val Ile Asn Ser Glu Gly Trp Gly Glu Phe His Val Asn Gly Gly Ser
Val Ser Ile Tyr Val Gln Arg

SEQ ID NO: 115

atggcgagtagtaccgagctggagcagggcgaggatcataatgcaggccttctactgggacgttcggagggaggaatctggtgggacacaat
acggcagagaatccctgaatgtagatgcaggcatatccgccatctggataccccggcgagcaagggcagggcggggectactcgatg
ggctacgacccctacgattactcgatctgggcgagttttaccagaagggaaccgttgagacccgcttcggctccaaggagagctcgtaaca
tgatctccacggccaccagtagcgcatcaagggtatagcggacatagtgataaaccaccgcgcaggtggagacctcgaatggaaccatac
gtcggcgactatacctggagcggactttctaagggtcgctccgggaaatacaaggccactacatggacttccatccaaacaactacagcacct
cagacgagggaaacctcgggtggctccagacattgatcacctcgtgcccttcaaccagtactggctgtggcgagcaacgagagctacgccg
cctacctcaggagcatagggatcgatgcgtggcgcttgactacgtaagggtctacggcgctgggtcgtcaaggactggctgagtcagtggtg
gctggtggcgctggcgagtagtgaggacaccaacgtcgtgctcctcaactggcgctacagcagcgcgccaaggtcttcgacttccc
gcttactacaagatggacgagggcctttgacaacaagaacattcccgccctggttacgccatccagaacggtgaaaccgtcgtcagcagggat
cccttcaaggcggttaccttctggttaaccacgatacgaacataatctggaacaagtaccctgcctatgccttcatctgacctacgaaggtcag
cccgctatcttctaccgcgactacgaggagtgggtcaacaaggacaaactcaacaacctcatatggattcacgagcacctggcagggggaag
caccagatccttactacgacgacgatgagctcatcttcatgagggaaggctacggcgacaggccgggttataacctacatcaacctcggt
agcgactggcgaggagatgggtgaacgttggtcaaggttcgggctatacatccacgaatacaccggaaacctcggcggttggtcg
acaggtacgtccagtagcagcgtgggtcaagcttaccgctccgacacgatccggcgaacggctattacggctactcgtctggagctacg
ccggagtgggaagatctcatcaccatcaccatcactaa

SEQ ID NO: 116

Met Ala Lys Tyr Ser Glu Leu Glu Gln Gly Gly Val Ile Met Gln Ala Phe Tyr Trp Asp Val Pro Glu
Gly Gly Ile Trp Trp Asp Thr Ile Arg Gln Lys Ile Pro Glu Trp Tyr Asp Ala Gly Ile Ser Ala Ile Trp
Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Ala Tyr Ser Met Gly Tyr Asp Pro Tyr Asp Tyr Phe Asp
Leu Gly Glu Phe Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Glu Glu Leu Val Asn Met

Figure 16SS



Ile Ser Thr Ala His Gln Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg Ala Gly Gly Asp
Leu Glu Trp Asn Pro Tyr Val Gly Asp Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala Ser Gly Lys Tyr
Lys Ala His Tyr Met Asp Phe His Pro Asn Asn Tyr Ser Thr Ser Asp Glu Gly Thr Phe Gly Gly Phe
Pro Asp Ile Asp His Leu Val Pro Phe Asn Gln Tyr Trp Leu Trp Ala Ser Asn Glu Ser Tyr Ala Ala
Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly Ala Trp Val Val
Lys Asp Trp Leu Ser Gln Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn Val Asp Ala Leu
Leu Asn Trp Ala Tyr Ser Ser Gly Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys Met Asp Glu Ala
Phe Asp Asn Lys Asn Ile Pro Ala Leu Val Tyr Ala Ile Gln Asn Gly Glu Thr Val Val Ser Arg Asp
Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asn Ile Ile Trp Asn Lys Tyr Pro Ala Tyr
Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Val Ile Phe Tyr Arg Asp Tyr Glu Glu Trp Leu Asn Lys
Asp Lys Leu Asn Asn Leu Ile Trp Ile His Glu His Leu Ala Gly Gly Ser Thr Lys Ile Leu Tyr Tyr
Asp Asp Asp Glu Leu Ile Phe Met Arg Glu Gly Tyr Gly Asp Arg Pro Gly Leu Ile Thr Tyr Ile Asn
Leu Gly Ser Asp Trp Ala Glu Arg Trp Val Asn Val Gly Ser Lys Phe Ala Gly Tyr Thr Ile His Glu
Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Arg Tyr Val Gln Tyr Asp Gly Trp Val Lys Leu Thr Ala
Pro Pro His Asp Pro Ala Asn Gly Tyr Tyr Gly Tyr Ser Val Trp Ser Tyr Ala Gly Val Gly Arg Ser
His His His His His His

SEQ ID NO: 117

ttgcgagtgttctggtgtgccaaagctgagccgcccatttcaggcagagtcacaacaacaagacagggacataacaatgaacacacagcg
ggaatgctggcgatcgaggtatgctgatcgcccccttggcgcatgcccgatgtcatactgcacgccttaactggaaatacagtgaagtcaccg
ccaaggccgatctcatcaaggctgccggctacaagcaggtgctcatctaccgcctctgaagtcctcgggcaacagagtgtgggctcgttacc
agccccaggtatcgccctggtcgacaccccccttggaacaagcaggatctggagcagctgatcgccgcatgagacccggggcattgc
cgtctacgcggagctggtgctcaaccacatggccaacgaagctggaagcgcagcgacctaactaccccggcagcgagctgtgcaaag
ctacgccggcaatccggcctactttgaacgccagaagctctttggcgatctggggcagaacttctcgcggccaggtttcatccggagggg
tgcataccgactggaacaatccgggccaatgtccagtgactggtgctgctggcgggggcggtgacaaggggctgccggatctggacccca
acaactgggtggtgaaccagcaacaggttacctgcaggcgctcaaggggatggggatcaagggttttcgggtcgatcggtcaagcacatg
agcgattaccagatcaacgcctgtttacccccgagatcaaacaggggatgcacgtctttggcgaggtgatcaccacggggggcgccggca
acagcgactatgagaacttctcaaacctacctcgacagcagcgccaggggcgctacgacttcccgccttctgcctccctgcgtggagcgc
tgggtacggcgagcatgaacctgctggccgatcccggtgcctatggtcaggcgctgcccggtagccgcgccgtcaccttcgccatcacc
cagcatccccaccaacgacggtttccgctaccagatcctcaaccagaccgacgagagactggcctatgcctacctgctcggtcgcatggc
ggttcgctctggttactccgatcacgggtgaaccagggaaggacggattgcgtggcaggactactatctgcgcaccgatctcaaaggg
atgatccgcttcataacacagtgcagggtcaaccgatgcagctcatcggcagtaacgactgcttcgtgttcaagcgtggcaagcagggc
gtggtcggcataacaagtgcgactacgagcaggagtactggctcgataccgccagattcgagatgaactggtatcgcaactaccgggatgtg
ctcgaccagaatgccgtggtcaacgtgcagagccagtggtgaaggctgacctccccggcccgccgagccagaatgtggctgcaggagtga

SEQ ID NO: 118

Met Arg Val Phe Leu Val Val Pro Lys Leu Ser Arg Pro Phe Gln Ala Glu Ser Gln Gln Gln Asp Arg
Asp Ile Thr Met Lys His Thr Ala Gly Met Leu Ala Ile Ala Gly Met Leu Ile Ala Pro Leu Ala His
Ala Asp Val Ile Leu His Ala Phe Asn Trp Lys Tyr Ser Glu Val Thr Ala Lys Ala Asp Leu Ile Lys
Ala Ala Gly Tyr Lys Gln Val Leu Ile Ser Pro Pro Leu Lys Ser Ser Gly Asn Glu Trp Trp Ala Arg
Tyr Gln Pro Gln Asp Leu Arg Leu Val Asp Thr Pro Leu Gly Asn Lys Gln Asp Leu Glu Gln Leu Ile
Ala Ala Met Gln Thr Arg Gly Ile Ala Val Tyr Ala Asp Val Val Leu Asn His Met Ala Asn Glu Ser
Trp Lys Arg Ser Asp Leu Asn Tyr Pro Gly Ser Glu Leu Leu Gln Ser Tyr Ala Gly Asn Pro Ala Tyr
Phe Glu Arg Gln Lys Leu Phe Gly Asp Leu Gly Gln Asn Phe Leu Ala Gly Gln Asp Phe His Pro
Glu Gly Cys Ile Thr Asp Trp Asn Asn Pro Gly His Val Gln Tyr Trp Arg Leu Cys Gly Gly Ala Gly
Asp Lys Gly Leu Pro Asp Leu Asp Pro Asn Asn Trp Val Val Asn Gln Gln Gln Ala Tyr Leu Gln
Ala Leu Lys Gly Met Gly Ile Lys Gly Phe Arg Val Asp Ala Val Lys His Met Ser Asp Tyr Gln Ile
Asn Ala Val Phe Thr Pro Glu Ile Lys Gln Gly Met His Val Phe Gly Glu Val Ile Thr Thr Gly Gly
Ala Gly Asn Ser Asp Tyr Glu Asn Phe Leu Lys Pro Tyr Leu Asp Ser Ser Gly Gln Gly Ala Tyr Asp
Phe Pro Leu Phe Ala Ser Leu Arg Gly Ala Leu Gly Tyr Gly Gly Ser Met Asn Leu Leu Ala Asp Pro

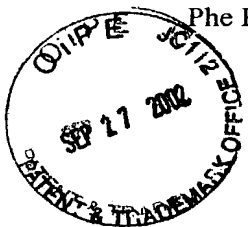


Figure 16TT

Gly Ala Tyr Gly Gln Ala Leu Pro Gly Ser Arg Ala Val Thr Phe Ala Ile Thr His Asp Ile Pro Thr
Asn Asp Gly Phe Arg Tyr Gln Ile Leu Asn Gln Thr Asp Glu Arg Leu Ala Tyr Ala Tyr Leu Leu Gly
Arg Asp Gly Gly Ser Pro Leu Val Tyr Ser Asp His Gly Glu Thr Arg Asp Lys Asp Gly Leu Arg Trp
Gln Asp Tyr Tyr Leu Arg Thr Asp Leu Lys Gly Met Ile Arg Phe His Asn Thr Val Gln Gly Gln Pro
Met Gln Leu Ile Gly Ser Asn Asp Cys Phe Val Leu Phe Lys Arg Gly Lys Gln Gly Val Val Gly Ile
Asn Lys Cys Asp Tyr Glu Gln Glu Tyr Trp Leu Asp Thr Ala Arg Phe Glu Met Asn Trp Tyr Arg
Asn Tyr Arg Asp Val Leu Asp Gln Asn Ala Val Val Asn Val Gln Ser Gln Trp Val Arg Leu Thr Ile
Pro Ala Arg Gly Ala Arg Met Trp Leu Gln Glu

SEQ ID NO: 119

atgcaaacgtttgcattcttattttactcaagaaaggatgggtgtgcatgaattatttgaaaaaagtgtggtgtattacgctatcgtcgtacacctaa
tcatttcctttcttacacctttttcaacagcacaagctaatactgcacctgttaacggaacaatgatgcaatatttgaatgggacttacctaagtgatgg
gacgctttggacgaaagtaaaaaatgaagctaccaatctttctcactaggtatcacagcactatggctccctccagcatataaaggaacgagcc
aaagcgatgctggatcaggtgtttacgatttatgaccttggggaatttaatacaaaaaggagacatccgaacgaaatacggaaacaaaaacaca
atatattcaagccattcaaacgtcccaagccgcagggatgcaagtatatgctggatgtttgatttaatacagaagcaggggctgacagtacagaatt
tgtgatgacgttgaggtaaaccttctaatacgaatacaagaacatctggcacatatcaaatcaagcatggacaaaatttgatttctggtcgtg
gaaacacatactccagcttcaaatggcgtgtgtaccattttgatggtacggattgggacgaaagtcgtaaatcaatcgtatttacaattccgcgg
tacaggaagcgtgggactgggaagtcgatacagaaaacggaactatgattttaatgttcgctgatttagatatggatcacctgaggtgtg
gacagaattaaaaactggggaacgtgtacgtcaatactacaataatcgatggattccgcttagatgccgtaaacatattaaatacagcttttc
cctgactggctaacatgtacgtaatacaacaggaaaaaatttatttgcggttggggaattttggagctatgacgtcaataagctgcataattacat
tacaacaaacaaatgggtcgatgtcattttgatgcaccttgcataacaactttataccgcttccaaatcgatggatatttgacatgcgttattat
tgaataatacattaatgaaagatcaaccttcactcgtgtaacacttgcgataaccacgacacgcaaccagggcaatctttacagtcattgggtcg
aaccttgggttaaacagcttgccttacgcctttattttaacaagacaagaagggtatcccttgcgtattttacgggtgattatttggaatccctaaatacaat
atcccggggttaaaaagtaaaatcgacccgcttttaattgctcgtcgtgattacgcttatggaacacaacgtgattacattgatcatcaagacattat
cggatggacacgagaaggcattgatgcaaaaccgaactctggactggcggttaattaccgacggctcgttggaagtaaatggatgtatgtc
ggtaaaaagcatgccgggaaagtatttatgatttaactggaatcgaagtgcacagtaaacgattaatgcggatgggtgggagaaatttaagta
aacggagatccgctcaatttgggtggctaaaacgtcaaacgtcacatttacagtcataaacgccacaacaacaagcggacaaaacgtatatg
ttgctggcaacattccagagctaggaattgtcgcacgggttaa

SEQ ID NO: 120

Met Gln Thr Phe Ala Phe Leu Phe Tyr Ser Lys Lys Gly Trp Val Cys Met Asn Tyr Leu Lys Lys Val
Trp Leu Tyr Tyr Ala Ile Val Ala Thr Leu Ile Ile Ser Phe Leu Thr Pro Phe Ser Thr Ala Gln Ala Asn
Thr Ala Pro Val Asn Gly Thr Met Met Gln Tyr Phe Glu Trp Asp Leu Pro Asn Asp Gly Thr Leu
Trp Thr Lys Val Lys Asn Glu Ala Thr Asn Leu Ser Ser Leu Gly Ile Thr Ala Leu Trp Leu Pro Pro
Ala Tyr Lys Gly Thr Ser Gln Ser Asp Val Gly Tyr Gly Val Tyr Asp Leu Tyr Asp Leu Gly Glu Phe
Asn Gln Lys Gly Thr Ile Arg Thr Lys Tyr Gly Thr Lys Thr Gln Tyr Ile Gln Ala Ile Gln Thr Ala
Gln Ala Ala Gly Met Gln Val Tyr Ala Asp Val Val Phe Asn His Lys Ala Gly Ala Asp Ser Thr Glu
Phe Val Asp Ala Val Glu Val Asn Pro Ser Asn Arg Asn Gln Glu Thr Ser Gly Thr Tyr Gln Ile Gln
Ala Trp Thr Lys Phe Asp Phe Pro Gly Arg Gly Asn Thr Tyr Ser Ser Phe Lys Trp Arg Trp Tyr His
Phe Asp Gly Thr Asp Trp Asp Glu Ser Arg Lys Leu Asn Arg Ile Tyr Lys Phe Arg Gly Thr Gly Lys
Ala Trp Asp Trp Glu Val Asp Thr Glu Asn Gly Asn Tyr Asp Tyr Leu Met Phe Ala Asp Leu Asp
Met Asp His Pro Glu Val Val Thr Glu Leu Lys Asn Trp Gly Thr Trp Tyr Val Asn Thr Thr Asn Ile
Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Lys Tyr Ser Phe Phe Pro Asp Trp Leu Thr Tyr Val
Arg Asn Gln Thr Gly Lys Asn Leu Phe Ala Val Gly Glu Phe Trp Ser Tyr Asp Val Asn Lys Leu His
Asn Tyr Ile Thr Lys Thr Asn Gly Ser Met Ser Leu Phe Asp Ala Pro Leu His Asn Asn Phe Tyr Thr
Ala Ser Lys Ser Ser Gly Tyr Phe Asp Met Arg Tyr Leu Leu Asn Asn Thr Leu Met Lys Asp Gln
Pro Ser Leu Ala Val Thr Leu Val Asp Asn His Asp Thr Gln Pro Gly Gln Ser Leu Gln Ser Trp Val
Glu Pro Trp Phe Lys Gln Leu Ala Tyr Ala Phe Ile Leu Thr Arg Gln Glu Gly Tyr Pro Cys Val Phe
Tyr Gly Asp Tyr Tyr Gly Ile Pro Lys Tyr Asn Ile Pro Gly Leu Lys Ser Lys Ile Asp Pro Leu Leu Ile
Ala Arg Arg Asp Tyr Ala Tyr Gly Thr Gln Arg Asp Tyr Ile Asp His Gln Asp Ile Ile Gly Trp Thr

Figure 16UU



Arg Glu Gly Ile Asp Ala Lys Pro Asn Ser Gly Leu Ala Ala Leu Ile Thr Asp Gly Pro Gly Gly Ser
Lys Trp Met Tyr Val Gly Lys Lys His Ala Gly Lys Val Phe Tyr Asp Leu Thr Gly Asn Arg Ser Asp
Thr Val Thr Ile Asn Ala Asp Gly Trp Gly Glu Phe Lys Val Asn Gly Gly Ser Val Ser Ile Trp Val
Ala Lys Thr Ser Asn Val Thr Phe Thr Val Asn Asn Ala Thr Thr Thr Ser Gly Gln Asn Val Tyr Val
Val Gly Asn Ile Pro Glu Leu Gly Asn Cys Arg Thr Gly

SEQ ID NO: 121

atgctcgccctgtcgtcggcggtgcggcatcgacgcgggcccacaggccctcgctcgtggagccgctgccgcagcgcggccacgcttc
cgcaggagtaccgcggcagcggccacgcggccgcccgcgacgtgttcgacactgttcgagtggaagtggccggacatcgccggaggaat
gcgagaacgtgtcggggccggcggtacgagcggtgcaggtgtcgccgccgagggagcacctggtcagcagggggcgccgtggtg
gcagcggtaccagccggtgagctactcgggtgcgctgagccgcagcggcgacggcggtggagttcagcaacatgatcagccggtgcaaggc
cgccggcggtggacatctacgtggacgccgtcatcaaccacatgacggccggtgcggggagcaggggagcaacggcaccgctacaccaagta
caactacccggcctgtacgcgcagcgggactttcacccgcagtgccggtggggcactacaccagcggcccaacgtgcaggactgcga
actgctggggctggctgacctgaacaccggcgccggcggtgcagcagaagatcgccgactacctggctcgtggcgcggtggcggt
ggcggttttcgcatcgacgcggccaagcacatccagccggtggaactggacgccatcgtggaccgctgaaccagacgctggcgcgga
ggggcgccccgttccctactggttcgaggtgatcacaacggcgccgagggggtgcggcgagcactactacggcctgggatacgg
caccggcgccgcggacatcacggagttccgctacaagggcggtggcgacaagtctcgggcagcggcgccagcggctggtggacc
tgaagaacttctcggcggtgacgtggaacctgatccgctcggaagggcgctcgtcttctggagaaccacgatacgcagcggcgccggcg
atcggtaccgcgatggcagcggttcggctggccaacgtgtggtgctgcgcagccgtacggctatccgtcggtgatgtccagctacgc
ctttgaccgcacctcccccttggccgcgacgccggcccgccctccgaggacggcgcgacgaaggacgtgacgtgcgcggccacgctgga
gacggcggtgctgggcacctgggtgtgcgagcaccgcgaccccgctcattcagcggtggtggcttcgccgcgcatggcgggcacgga
cctgaaccgctggtgggacaacggcggaacgccattgcttttcgcggggacggggcttcgctgccatcagccgcgagccgaaggtg
accatggcgccggtgccagcggaactgtccccggcacctactgcgacgtgctgaccggcggaaggtgggaacgcctgcgcgggaac
cagcgtgacggctgactctcaggcggtggtgcagctgagcatcgtcgagaactcggctcgtggtgatccacctcggggccaagctgaacggc
gcgctggcggtatgtgcggaggg

SEQ ID NO: 122

Met Leu Ala Leu Ser Leu Gly Gly Cys Gly Ile Asp Ala Gly Pro Thr Gly Pro Arg Val Val Glu Pro
Leu Pro Gln Arg Pro Thr Leu Pro Gln Glu Tyr Arg Ala Ser Gly His Ala Ala Ala Gly Asp Val Phe
Val His Leu Phe Glu Trp Lys Trp Pro Asp Ile Ala Glu Glu Cys Glu Asn Val Leu Gly Pro Ala Gly
Tyr Glu Ala Val Gln Val Ser Pro Pro Gln Glu His Leu Val Gln Gln Gly Ala Pro Trp Trp Gln Arg
Tyr Gln Pro Val Ser Tyr Ser Val Ala Leu Ser Arg Ser Gly Thr Gly Val Glu Phe Ser Asn Met Ile
Ser Arg Cys Lys Ala Ala Gly Val Asp Ile Tyr Val Asp Ala Val Ile Asn His Met Thr Ala Gly Ala
Gly Thr Gly Ser Asn Gly Thr Ala Tyr Thr Lys Tyr Asn Tyr Pro Gly Leu Tyr Ala Gln Ala Asp Phe
His Pro Gln Cys Ala Val Gly Asp Tyr Thr Ser Ala Ala Asn Val Gln Asp Cys Glu Leu Leu Gly Leu
Ala Asp Leu Asn Thr Gly Ala Ala Gly Val Gln Gln Lys Ile Ala Asp Tyr Leu Val Ser Leu Ala Arg
Leu Gly Val Ala Gly Phe Arg Ile Asp Ala Ala Lys His Ile Gln Pro Val Glu Leu Asp Ala Ile Val
Asp Arg Val Asn Gln Thr Leu Ala Ala Glu Gly Arg Pro Leu Pro Tyr Trp Phe Ala Glu Val Ile Asp
Asn Gly Gly Glu Gly Val Arg Arg Glu His Tyr Tyr Gly Leu Gly Tyr Gly Thr Gly Gly Ala Ala Asp
Ile Thr Glu Phe Arg Tyr Lys Gly Val Gly Asp Lys Phe Leu Gly Ser Gly Gly Gln Arg Leu Val Asp
Leu Lys Asn Phe Ser Ala Val Thr Trp Asn Leu Met Pro Ser Asp Lys Ala Val Val Phe Leu Glu Asn
His Asp Thr Gln Arg Gly Gly Gly Ile Gly Tyr Arg Asp Gly Thr Ala Phe Arg Leu Ala Asn Val Trp
Met Leu Ala Gln Pro Tyr Gly Tyr Pro Ser Val Met Ser Ser Tyr Ala Phe Asp Arg Thr Ser Pro Phe
Gly Arg Asp Ala Gly Pro Pro Ser Glu Asp Gly Ala Thr Lys Asp Val Thr Cys Ala Pro Thr Leu Glu
Thr Ala Val Leu Gly Thr Trp Val Cys Glu His Arg Asp Pro Val Ile Gln Arg Met Val Gly Phe Arg
Arg Ala Met Ala Gly Thr Asp Leu Asn Arg Trp Asp Asn Gly Gly Asn Ala Ile Ala Phe Ser Arg
Gly Asp Arg Gly Phe Val Ala Ile Ser Arg Glu Pro Lys Val Thr Met Ala Ala Val Pro Ser Gly Leu
Ser Pro Gly Thr Tyr Cys Asp Val Leu Thr Gly Gly Lys Val Gly Asn Ala Cys Ala Gly Thr Ser Val
Thr Val Asp Ser Gln Gly Val Val Gln Leu Ser Ile Val Glu Asn Ser Ala Leu Val Ile His Leu Gly
Ala Lys Leu Arg Arg Ala Gly Gly Cys Ala Glu

Figure 16VV



SEQ ID NO: 123

atgccccaggccattcgcactttttcacgttgagcgtgttcggccttaatcggcggttttctgcttggctcgtcttttctgtcccaccccgaggcaatcc
aggcccagacaaccccgggccgtaccgttatgggtcacctcttcgagtggaatggaccgacatcgtaaagaatgcgagaatttctcggac
cgaaaggctttgcccgaatccaggtatcgccgcccaggagcatgcccaggggtcgcaatgggtggaccgcgtatcagccggcagctacaag
atcgagagccgctccggcaccggggcggcaggttcgccaatatggtctcgcgctgcaaagccgctcgggggtcgatatctatgctgatgccgtgatc
aaccatgatgagactgtcggctccggcactgggtatggctggatcgacctacaccagctacacctatccggggctgtatcagaccaggacttcc
accactgccccggcgaatggcaacgatgatacagcagctacggcgatcgctgggaagtacaaaactgcgaactgctcaacctagccgacctc
aacaccggcgctgagtatgtccggggtaaactcgccgcctatatgaacgatctgcgcggcctggggcgtcgccggatttcggatcgatgccgcc
aagcacatggataccaacgacatcaacaatatcgttgccgcctgcccacgcgcctacatctaccaggaagtatcgaccagggcgggcga
gccaattaccggcgccgaatacttcagaatggcgatgtgaccgagttcaagtacagccgcgagatctcgcgcatgttcaaaacggccagct
gacccatatgagccagttcggcactgcctggggcttcatgtccagcgacctggcagtagttttaccgataaccacgacaaccagcgcggtca
cgcgggcgccggcgatgtcttgacctacaagatggccagctgtacacctgggcaatatcttcgagctagcctggccgtatggctaccaca
ggctcatgtcgagctacacgttcagcaacggcgaccagggggcccatcgaccaatgtgtacgcaaccacaacgcctgattgtggcaacggcc
gctgggtctgtgagcaccgctggcgagggaatcgccaacatggtcgcgttcgcaactacaccgccccgaccttcagcaccagcaactggtgg
agcaacggcaacaaccagatcgctttcagccgcgggaccctgggctttgtggcgatcaatcggaaggtggcagcctgaaccgacacctcca
aaccggcctgcccgtcgccacctactgcgatgtcattcacggcgatttcaatgccagcgccggcacctgttccggcccaactatcgctgtcaac
ggctccggacaggcaaccatcacgggtcaacgcgatggacgcggtggcgatctacggcgagccaggctcgccactccggccagtgtaac
gtgacattcaacgaaaacgccacgaccacctgggggcagaatgtgtatatctgcggcaacgtcgccgcctgggcagctggaacgcaggca
gcgcggtcttactctctccgtaactaccaatctggagcaagaccatcgccctgccagccaacaccgccattgagtacaagtacatcaaaaa
ggatggcgcgggcgaatgtggtgtgggaaagcggcgccaaccgcgtctttaccacccccggcagcgagtgccacgcgcaacgatacctg
gaaatag

SEQ ID NO: 124

Met Pro Gln Ala Ile Arg Thr Phe Ser Arg Trp Thr Leu Phe Gly Leu Ile Gly Val Phe Leu Leu Gly
Leu Val Phe Ser Val Pro Pro Arg Ala Ile Gln Ala Gln Thr Thr Pro Ala Arg Thr Val Met Val His
Leu Phe Glu Trp Lys Trp Thr Asp Ile Ala Lys Glu Cys Glu Asn Phe Leu Gly Pro Lys Gly Phe Ala
Ala Ile Gln Val Ser Pro Pro Gln Glu His Val Gln Gly Ser Gln Trp Trp Thr Arg Tyr Gln Pro Val Ser
Tyr Lys Ile Glu Ser Arg Ser Gly Thr Arg Ala Glu Phe Ala Asn Met Val Ser Arg Cys Lys Ala Val
Gly Val Asp Ile Tyr Val Asp Ala Val Ile Asn His Met Thr Thr Val Gly Ser Gly Thr Gly Met Ala
Gly Ser Thr Tyr Thr Ser Tyr Thr Tyr Pro Gly Leu Tyr Gln Thr Gln Asp Phe His His Cys Gly Arg
Asn Gly Asn Asp Asp Ile Ser Ser Tyr Gly Asp Arg Trp Glu Val Gln Asn Cys Glu Leu Leu Asn
Leu Ala Asp Leu Asn Thr Gly Ala Glu Tyr Val Arg Gly Lys Leu Ala Ala Tyr Met Asn Asp Leu
Arg Gly Leu Gly Val Ala Gly Phe Arg Ile Asp Ala Ala Lys His Met Asp Thr Asn Asp Ile Asn Asn
Ile Val Gly Arg Leu Pro Asn Ala Pro Tyr Ile Tyr Gln Glu Val Ile Asp Gln Gly Gly Glu Pro Ile Thr
Ala Gly Glu Tyr Phe Gln Asn Gly Asp Val Thr Glu Phe Lys Tyr Ser Arg Glu Ile Ser Arg Met Phe
Lys Thr Gly Gln Leu Thr His Met Ser Gln Phe Gly Thr Ala Trp Gly Phe Met Ser Ser Asp Leu Ala
Val Val Phe Thr Asp Asn His Asp Asn Gln Arg Gly His Gly Gly Ala Gly Asp Val Leu Thr Tyr
Lys Asp Gly Gln Leu Tyr Thr Leu Gly Asn Ile Phe Glu Leu Ala Trp Pro Tyr Gly Tyr Pro Gln Val
Met Ser Ser Tyr Thr Phe Ser Asn Gly Asp Gln Gly Pro Pro Ser Thr Asn Val Tyr Ala Thr Thr Thr
Pro Asp Cys Gly Asn Gly Arg Trp Val Cys Glu His Arg Trp Arg Gly Ile Ala Asn Met Val Ala Phe
Arg Asn Tyr Thr Ala Pro Thr Phe Ser Thr Ser Asn Trp Trp Ser Asn Gly Asn Asn Gln Ile Ala Phe
Ser Arg Gly Thr Leu Gly Phe Val Ala Ile Asn Arg Glu Gly Gly Ser Leu Asn Arg Thr Phe Gln Thr
Gly Leu Pro Val Gly Thr Tyr Cys Asp Val Ile His Gly Asp Phe Asn Ala Ser Ala Gly Thr Cys Ser
Gly Pro Thr Ile Ala Val Asn Gly Ser Gly Gln Ala Thr Ile Thr Val Asn Ala Met Asp Ala Val Ala Ile
Tyr Gly Gly Ala Arg Leu Ala Thr Pro Ala Ser Val Asn Val Thr Phe Asn Glu Asn Ala Thr Thr Thr
Trp Gly Gln Asn Val Tyr Ile Val Gly Asn Val Ala Ala Leu Gly Ser Trp Asn Ala Gly Ser Ala Val
Leu Leu Ser Ser Ala Asn Tyr Pro Ile Trp Ser Lys Thr Ile Ala Leu Pro Ala Asn Thr Ala Ile Glu Tyr
Lys Tyr Ile Lys Lys Asp Gly Ala Gly Asn Val Val Trp Glu Ser Gly Ala Asn Arg Val Phe Thr Thr
Pro Gly Ser Gly Ser Ala Thr Arg Asn Asp Thr Trp Lys



Figure 16WW

SEQ ID NO: 125

gtgtgcacatgaagtgaagtaccttgccttagttttgttgctgtggcttcgataggcctactctgactccagtggtgctgccaagtactccg
aactcgaagaggggcgtgttataatgcaggccttctactgggatgttcccgagggggaatctggtgggacaccataagacagaaaatcccg
gagtgttacgacgctggaatcctggcgatattgattcctccagctagcaaagggatggcggtgttattccatgggctacgatccctacgattt
ctttgacctggcgagtactatcagaagggaacagttgagacgccttcggctcaaaggagggaactggtgaacatgataaacaccgcacactc
ctatggcataaagggtgatagcggacatagtcataaacaccgcgcgggtggagacctgagtggaacccctttgtaaacatactattggaca
gacttctcaaggtcgctccggttaaatacacggccaactaccttgacttcacccaaacgaggtaagtgtcgatgagggtacatttgggtga
ctttcggacatcgccacgagaagagctgggatcagctactggctctgggcaagcaatgagagctacgcccatatctccggagcataggga
tcgatgcatggcgtttcgactactgcaaaaggttacggagcgtgggtgttaatgactggctcagctggtggggaggctgggcccgttgagagta
ctgggacacgaacgttgatgcactccttaactgggcatacagacgcggtgccaaggtcttgacttcccgtctactacaagatggacgaagcc
tttgacaacaccaacatccccgctttgtgttacgccctccagaacggagggaacagctggttcccgcgatccctcaaggcagtaactttcgtgcc
aaccacgatacagatataatctggaacaagtatccggcttatgcgttcatccttacctatgaggggacagcctgttatatttaccgcgactacgagg
agtggctcaacaaggataagcttaacaaccttatctggatacacgagcaccttccggagggaagtaccaagatccttactacgataacgatga
gctaattatcatgaggggagggtacgggagcaagccgggcctcataacctacataaacctcgaaacgactgggcccagcgctgggtgaac
gtcggctcaaatgttccggctacacaatccatgaatacacaggcaatctcgggtggctgggttgacaggtgggttcagtagatggatgggtta
aactgacggcacctcctcatgatccagccaacggatattacggctactcagctctggagctacgcaggcgtcggatga

SEQ ID NO: 126

Val Val His Met Lys Leu Lys Tyr Leu Ala Leu Val Leu Leu Ala Val Ala Ser Ile Gly Leu Leu Ser
Thr Pro Val Gly Ala Ala Lys Tyr Ser Glu Leu Glu Glu Gly Gly Val Ile Met Gln Ala Phe Tyr Trp
Asp Val Pro Gly Gly Gly Ile Trp Trp Asp Thr Ile Arg Gln Lys Ile Pro Glu Trp Tyr Asp Ala Gly Ile
Ser Ala Ile Trp Ile Pro Pro Ala Ser Lys Gly Met Gly Gly Gly Tyr Ser Met Gly Tyr Asp Pro Tyr
Asp Phe Phe Asp Leu Gly Glu Tyr Tyr Gln Lys Gly Thr Val Glu Thr Arg Phe Gly Ser Lys Glu Glu
Leu Val Asn Met Ile Asn Thr Ala His Ser Tyr Gly Ile Lys Val Ile Ala Asp Ile Val Ile Asn His Arg
Ala Gly Gly Asp Leu Glu Trp Asn Pro Phe Val Asn Asn Tyr Thr Trp Thr Asp Phe Ser Lys Val Ala
Ser Gly Lys Tyr Thr Ala Asn Tyr Leu Asp Phe His Pro Asn Glu Val Lys Cys Cys Asp Glu Gly Thr
Phe Gly Asp Phe Pro Asp Ile Ala His Glu Lys Ser Trp Asp Gln Tyr Trp Leu Trp Ala Ser Asn Glu
Ser Tyr Ala Ala Tyr Leu Arg Ser Ile Gly Ile Asp Ala Trp Arg Phe Asp Tyr Val Lys Gly Tyr Gly
Ala Trp Val Val Asn Asp Trp Leu Ser Trp Trp Gly Gly Trp Ala Val Gly Glu Tyr Trp Asp Thr Asn
Val Asp Ala Leu Leu Asn Trp Ala Tyr Asp Ser Gly Ala Lys Val Phe Asp Phe Pro Leu Tyr Tyr Lys
Met Asp Glu Ala Phe Asp Asn Thr Asn Ile Pro Ala Leu Val Tyr Ala Leu Gln Asn Gly Gly Thr Val
Val Ser Arg Asp Pro Phe Lys Ala Val Thr Phe Val Ala Asn His Asp Thr Asp Ile Ile Trp Asn Lys
Tyr Pro Ala Tyr Ala Phe Ile Leu Thr Tyr Glu Gly Gln Pro Val Ile Phe Tyr Arg Asp Tyr Glu Glu
Trp Leu Asn Lys Asp Lys Leu Asn Asn Leu Ile Trp Ile His Glu His Leu Ala Gly Gly Ser Thr Lys
Ile Leu Tyr Tyr Asp Asn Asp Glu Leu Ile Phe Met Arg Glu Gly Tyr Gly Ser Lys Pro Gly Leu Ile
Thr Tyr Ile Asn Leu Gly Asn Asp Trp Ala Glu Arg Trp Val Asn Val Gly Ser Lys Phe Ala Gly Tyr
Thr Ile His Glu Tyr Thr Gly Asn Leu Gly Gly Trp Val Asp Arg Trp Val Gln Tyr Asp Gly Trp Val
Lys Leu Thr Ala Pro Pro His Asp Pro Ala Asn Gly Tyr Tyr Gly Tyr Ser Val Trp Ser Tyr Ala Gly
Val Gly

SEQ ID NO: 127

gtgtgcataaattttgaaaaaagtgtggtgtattacgctatcgtcgtactcttaatacttcttctacgcccttttcaactgcacaagccaacac
tgaccagtcacggaacgatgatcaataattcgaatgggattaccgaatgatggcacactttggacgaaagtaaaaaacgaagcaagcagt
ctttcttcttaggtattactgcgttatggttaccctgcatacaaaaggaacgagccaaggggatgctgggtatggcgtgtacgatttgtatgactt
aggagaatttaatacaaaaaggacgattcgaacgaaatacgaacaaaaacgcaatattacaagccattcaagcggaacgctggcat
gcaagtatacgtgatgtcgtatttaatacaaggcggggcagatagtagagaatgggtgacgcagtcgaagtgaatccttcaatcgaacc
aagaacatctggcacatatcaaatcaagcatggacaaaatttgatttccctggccgtgggaacacatactcaagctttaatggcgatggtatc
atttgacggtagcggattgggatgaaagccgaaaactaaatcgtattacaatttcgtggcacaggaaaagcatgggattgggaagtagacaca
gagaacggaaactatgactacttaattgttgctgatttagatggtacccctgaagtcgtgacagagctaaaaaactggggaacatggtagctc

Figure 16XX



aatacgcacaaatgtc gatgggttcgcttagatgcagtaagcatattaaatatagcttctccagattgggtaacacatgtgcgttcacaaacacg
aaaaaatcttttgcagtaggagaattttggagctacgatgtcaataaactgcataactacattacaaaaacaagtgaaccatgtcgttatttgatg
cgccacttcataacaacttttactgcttcaaaatctagcgggtattttgacatgcgctattttgtaataatacgttgatgaaagaccagccttctct
tgcgggtcacactcgttgataatcatgacacgaaccgggacaatcttacaatcatgggtagagccttggttaagccgcttgcttatgcctttatttt
gacaagacaagaaggatattccttgctattttacggcgactattacggcatccctaaatacaacattccgggattgaaaagttaaactcatccgct
tctcattgcccgtagagactacgcatacgggaacacacacgtgattatattgacatcaagacattattggatggacacgggaaggaaattgactcaa
aaccgaactctggacttgcggctttaattactgacggccctgggtgaagtaaatggatgtatgtaggtaaaaagcatgctggaaaagtgttttacg
atctcactggaaatcgaaagcagatacggtaacgattatgcagacggctggggagagtttaaagtaaacgggtggctccgtttccatttgggttgc
aaaacatcacaagtcacgtttaccgtcaacaatgcgacaacgataagcggacaaaaatgtgtatgtcgttggttaacattccagagctcggaaattg
gaacacagcaaacgcaatcaaatgaccccatcttctatccaacgtggaaagcaaccattgctcttcacaaaggaaaagccattgaatttaaatt
tattaaaaagaccaatcggaatgtgtttgggaaagcattccaaaccgaacatacaccgttccattttatcaacaggctcatatacagctagtt
ggaatgtacctaa

SEQ ID NO: 128

Val Cys Met Asn Tyr Leu Lys Lys Val Trp Leu Tyr Tyr Ala Ile Val Ala Thr Leu Ile Ile Tyr Phe
Leu Thr Pro Phe Ser Thr Ala Gln Ala Asn Thr Ala Pro Val Asn Gly Thr Met Met Gln Tyr Phe Glu
Trp Asp Leu Pro Asn Asp Gly Thr Leu Trp Thr Lys Val Lys Asn Glu Ala Ser Ser Leu Ser Ser Leu
Gly Ile Thr Ala Leu Trp Leu Pro Pro Ala Tyr Lys Gly Thr Ser Gln Gly Asp Val Gly Tyr Gly Val
Tyr Asp Leu Tyr Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Ile Arg Thr Lys Tyr Gly Thr Lys Thr
Gln Tyr Leu Gln Ala Ile Gln Ala Ala Lys Ser Ala Gly Met Gln Val Tyr Ala Asp Val Val Phe Asn
His Lys Ala Gly Ala Asp Ser Thr Glu Trp Val Asp Ala Val Glu Val Asn Pro Ser Asn Arg Asn Gln
Glu Thr Ser Gly Thr Tyr Gln Ile Gln Ala Trp Thr Lys Phe Asp Phe Pro Gly Arg Gly Asn Thr Tyr
Ser Ser Phe Lys Trp Arg Trp Tyr His Phe Asp Gly Thr Asp Trp Asp Glu Ser Arg Lys Leu Asn Arg
Ile Tyr Lys Phe Arg Gly Thr Gly Lys Ala Trp Asp Trp Glu Val Asp Thr Glu Asn Gly Asn Tyr Asp
Tyr Leu Met Phe Ala Asp Leu Asp Met Asp His Pro Glu Val Val Thr Glu Leu Lys Asn Trp Gly
Thr Trp Tyr Val Asn Thr Thr Asn Val Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Lys Tyr Ser
Phe Phe Pro Asp Trp Leu Thr His Val Arg Ser Gln Thr Arg Lys Asn Leu Phe Ala Val Gly Glu Phe
Trp Ser Tyr Asp Val Asn Lys Leu His Asn Tyr Ile Thr Lys Thr Ser Gly Thr Met Ser Leu Phe Asp
Ala Pro Leu His Asn Asn Phe Tyr Thr Ala Ser Lys Ser Ser Gly Tyr Phe Asp Met Arg Tyr Leu Leu
Asn Asn Thr Leu Met Lys Asp Gln Pro Ser Leu Ala Val Thr Leu Val Asp Asn His Asp Thr Gln
Pro Gly Gln Ser Leu Gln Ser Trp Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu Thr
Arg Gln Glu Gly Tyr Pro Cys Val Phe Tyr Gly Asp Tyr Tyr Gly Ile Pro Lys Tyr Asn Ile Pro Gly
Leu Lys Ser Lys Ile Asp Pro Leu Leu Ile Ala Arg Arg Asp Tyr Ala Tyr Gly Thr Gln Arg Asp Tyr
Ile Asp His Gln Asp Ile Ile Gly Trp Thr Arg Glu Gly Ile Asp Ser Lys Pro Asn Ser Gly Leu Ala Ala
Leu Ile Thr Asp Gly Pro Gly Gly Ser Lys Trp Met Tyr Val Gly Lys Lys His Ala Gly Lys Val Phe
Tyr Asp Leu Thr Gly Asn Arg Ser Asp Thr Val Thr Ile Asn Ala Asp Gly Trp Gly Glu Phe Lys Val
Asn Gly Gly Ser Val Ser Ile Trp Val Ala Lys Thr Ser Gln Val Thr Phe Thr Val Asn Asn Ala Thr
Thr Ile Ser Gly Gln Asn Val Tyr Val Val Gly Asn Ile Pro Glu Leu Gly Asn Trp Asn Thr Ala Asn
Ala Ile Lys Met Thr Pro Ser Ser Tyr Pro Thr Trp Lys Ala Thr Ile Ala Leu Pro Gln Gly Lys Ala Ile
Glu Phe Lys Phe Ile Lys Lys Asp Gln Ser Gly Asn Val Val Trp Glu Ser Ile Pro Asn Arg Thr Tyr
Thr Val Pro Phe Leu Ser Thr Gly Ser Tyr Thr Ala Ser Trp Asn Val Pro

SEQ ID NO: 129

ttgcgttgcgcgcgtggcaggacgggtgttggtgcgggcggcgtaatgcgctgccgcgacacccgcgtgaacaaaataatgaattatttg
aataggatgggggtgtcaagaatgacaaaatctcgagagtgcggtgttcattgaaagtatttgggtgacctgttggtgatggcttgggga
tcttcgcgtccgcggcgtattgatgcaaggcttctactgggacgccagtaccgggaccagtgattcgttggtggacgcatttggccaagcaag
ccaacgggtctaaaacgggcgggttcaccggcgtatggattctccggtgcttaaaggggcttcagggggctattccaacgggtacgatccctt
tgacgactatgatactggaagcaaggaccagaaaggtaccgtggcgacgcgatgggggacgcgagaagaactgcaacgtgccgtggccgt
gatgcgcgcaacgggtctggatgtgtatgttgatctgggtgtaaccaccgcaacgggggacgcggaattggaattttcattacaaagatgc
gtacggcgaagtgggttacgggcgggttcaaaagggttttacgattttcaccccaactacaacattcaggatgccaatgttccaacgaggattc



Figure 16YY

Applicant(s): Walter Callen et al.
 ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
 METHODS OF USE THEREOF

cagcttcgggcgcgatttagcccatgacaatccgtatgtggccgatggactgaaggctgcaggcgattggctgaccaaagccctcgatgttca
 gggatatcgctggtacgtgaaaggcatcagctacaccttcctgaaaagtattctgtcctatggggccatgaacggaaaattgccgctcgggtga
 gtactgggatgccaaacgggatacgttgaactggtggcggaacacggcgatggaaggcgggcccatgtgttgattttgcgttcgcgagg
 agctgaaaaacatgtgcaatgcgggacgggtactacgacatgcgtcgattggaccacgcgggtctggtcggaatcgacccgtggaaggcgg
 gacgtttgtcgaaaaccatgatacggatcgccacgaccccatctacaataacaagcatttggcgtatgctacatcttgacgtcggaagggtatc
 cgacgggtgttctggaaggattactaccaatacgaatgaagccgatcgcgacaacctcatttggatccacgaacacattgcgtacggaacgac
 ccaagagcgttggaaagacgaagatgctttgtgtatgagcggacggagggaagcggtatttgggggcttaacgacaatcgccacca
 gcaaacggtcacgtacagaccggcttgggtgccaacgtggccttcacgactacacggcaacggccccgatctccgtaccgacgcctac
 ggtcgggtaaccttgaccattcctgcaaacgggtacgtggcctattcgttcggcgcatctccggatccttggccggtcgagaaaaccgtgac
 gcaggagtttgcggggcgctcgacttggatattcgtcggcgataacacgaatttgcaggtcggcgcatatacgcaagcaaacaa
 gccggttacagcgggaattgtattgggatgccaagactggacgacctccacgtcgatttctctagaagtgcgttcgggttcgggaacgctcatc
 acgacaaagaccgtgaccaattgtcgtcccagggtacccgcgttccttcacgccttcgggtaccggatgtgacgtctttccattcgaagctat
 aacacgccttcgacgaaccaaagccggcctactggttaaaggtaacgtatatacgccgccaattgcttcagtaa

SEQ ID NO: 130

Met Arg Cys Arg Arg Gly Arg Asp Gly Cys Trp Cys Gly Arg Arg Asn Ala Leu Pro Arg His Pro
 Arg Glu Gln Asn Asn Met Asn Tyr Leu Asn Arg Met Gly Val Ser Arg Met Thr Lys Ser Arg Glu
 Leu Arg Cys Ser Trp Lys Val Phe Val Val Gly Cys Leu Leu Trp Met Ala Trp Gly Ser Ser Ala Ser
 Ala Gly Val Leu Met Gln Gly Phe Tyr Trp Asp Ala Ser Thr Gly Thr Ser Asp Ser Trp Trp Thr His
 Leu Ala Lys Gln Ala Asn Gly Leu Lys Arg Ala Gly Phe Thr Ala Val Trp Ile Pro Pro Val Leu Lys
 Gly Ala Ser Gly Gly Tyr Ser Asn Gly Tyr Asp Pro Phe Asp Asp Tyr Asp Ile Gly Ser Lys Asp Gln
 Lys Gly Thr Val Ala Thr Arg Trp Gly Thr Arg Glu Glu Leu Gln Arg Ala Val Ala Val Met Arg Ala
 Asn Gly Leu Asp Val Tyr Val Asp Leu Val Leu Asn His Arg Asn Gly Asp Asp Gly Asn Trp Asn
 Phe His Tyr Lys Asp Ala Tyr Gly Lys Val Gly Tyr Gly Arg Phe Gln Lys Gly Phe Tyr Asp Phe His
 Pro Asn Tyr Asn Ile Gln Asp Ala Asn Val Pro Asn Glu Asp Ser Ser Phe Gly Arg Asp Leu Ala His
 Asp Asn Pro Tyr Val Ala Asp Gly Leu Lys Ala Ala Gly Asp Trp Leu Thr Lys Ala Leu Asp Val
 Gln Gly Tyr Arg Leu Asp Tyr Val Lys Gly Ile Ser Tyr Thr Phe Leu Lys Ser Tyr Leu Ser Tyr Gly
 Ala Met Asn Gly Lys Phe Ala Val Gly Glu Tyr Trp Asp Ala Asn Arg Asp Thr Leu Asn Trp Trp
 Ala Asn Thr Ala Met Glu Gly Arg Ala His Val Phe Asp Phe Ala Leu Arg Glu Glu Leu Lys Asn
 Met Cys Asn Ala Asp Gly Tyr Tyr Asp Met Arg Arg Leu Asp His Ala Gly Leu Val Gly Ile Asp
 Pro Trp Lys Ala Val Thr Phe Val Glu Asn His Asp Thr Asp Arg His Asp Pro Ile Tyr Asn Asn Lys
 His Leu Ala Tyr Ala Tyr Ile Leu Thr Ser Glu Gly Tyr Pro Thr Val Phe Trp Lys Asp Tyr Tyr Gln
 Tyr Gly Met Lys Pro Ile Ile Asp Asn Leu Ile Trp Ile His Glu His Ile Ala Tyr Gly Thr Thr Gln Glu
 Arg Trp Lys Asp Glu Asp Val Phe Val Tyr Glu Arg Thr Gly Gly Lys Arg Leu Leu Val Gly Leu
 Asn Asp Asn Arg Ala Thr Ser Lys Thr Val Thr Val Gln Thr Gly Phe Gly Ala Asn Val Ala Leu His
 Asp Tyr Thr Gly Asn Gly Pro Asp Leu Arg Thr Asp Ala Tyr Gly Arg Val Thr Leu Thr Ile Pro Ala
 Asn Gly Tyr Val Ala Tyr Ser Val Pro Gly Ile Ser Gly Ser Phe Val Pro Val Glu Lys Thr Val Thr
 Gln Glu Phe Ala Gly Ala Ser Asp Leu Asp Ile Arg Pro Ala Asp Asn Thr Gln Phe Val Gln Val Gly
 Arg Ile Tyr Ala Lys Ala Asn Lys Pro Val Thr Ala Glu Leu Tyr Trp Asp Ala Lys Asp Trp Thr Thr
 Ser Thr Ser Ile Leu Leu Glu Val Arg Ser Ala Ser Gly Thr Leu Ile Thr Thr Lys Thr Val Thr Gln Leu
 Ser Ser Gln Gly Thr Arg Val Ser Phe Thr Pro Ser Ala Thr Gly Trp Tyr Val Phe Ser Ile Arg Ser Tyr
 Asn Thr Pro Ser Thr Asn Pro Lys Pro Ala Tyr Trp Leu Lys Val Thr Tyr Thr Ala Pro Gln Leu Leu
 Gln

SEQ ID NO: 131

atgccgcagctttaccattgccgccgcgtggcgggcgcgccggcaggcgctggccgccttgacgctggccaccacggccctgggc
 atctcgacggccagccagagtgacacgcgcacggccttcgtgcatctgttcgaatggaagtggaccgacatcgcgcgagtgcgaga
 ccttctcgggccaagggttcgcggcggtgcaggtgtcggcccgacgagcacaactgggtgaccagcggtgatgggtcaccttatccg
 tgggtgatgcgtaccagccggtgagctacgcctggaccgcagccgcagcgcgccgaggttcaggacatggtcaaccgatgc
 aatgccgtggcggtgggcatctacgtggacgccgtgatcaatcacatgtccggcgccacggcgccacctcgagcgctggcgcgagctgg



Figure 16ZZ

agctatcacaaactaccctgggctctatggccccaacgacttccaccagccgggtgtgcagcatcaccaactacggggatgccaacaatgtgcag
cgttgcgagctctcgggcttgcaggacctggacactgggagcgccttatgtgcgggcaagatcgccgactatctggtgatctgtcaacatg
ggggtaagggcttccgggtgatgcggccaagcacatcagccgaccgacctggggccatcatgatcggtcaacagccgcaccggc
gcgaaccgccccttctggttctggaggtgattggcgcggccggcgaggcagtgccgaaccagtacttctcgtcggcgccggccaggt
cacctgaccgagttcaactatgggaagcaaatcttcggcaagttcgccgggtggcggcgtctggccgagctgcgcagcttcggtgaaacctg
ggcctgatgccagcagcaagcgattgcttcatcgacaaccacgacaagcagcgcggtcagtcggcggttgcaactatctgacctacc
accatggctcgacctagatctggccaacatcttcatgctggttggccttatggctacccggcgtgatgtccagctatgccttcaaccgcagc
acggcctacgacacgagcttggcccgccacacgacagtgggtggcgccacccgtggccctgggatggtggcgccagccagccggcctgc
ttcaaccagagcatcggtggctgggtgtgtgagcaccgctggcggggcatcgccaatatggtggccttcgcaacgccacgctgccaactg
gacctgaccgactggtgggacaacggcaacaaccagatcgcttccggcggggtgacaagggttcgtggtgatcaaccgcgaagacgc
cgcgctgacgcgaactcaagaccagcctgccagccggccagctactgcgatgtcatctccggggacttcaacaatggtcagtcacggggcc
atgtggtgacggctgatccggcggtacgtgacgctgacggcgccggcccaatggtgcggcgccatccacgtggcgcccgctctggacg
gcgcctctcagccgccgacgacctcgtgacgttcaacgcgtcgccgatacttttggggacagaacctgttcgtcgtgggaaccaca
gcgcactgggcaactggtgcggcgccggccgagccgatgacttgatttcgggttcgggcacgcgcgggaactggcgcgcggtgctca
atttgcggccaataaccactaccaatacaagtcatcaagaaggacggggctggaacgtggttgggagggcggtggcaatcgctcgtga
ccacgccgtctggggcggtatcggtgagcacggcgccgaattggcagtag

SEQ ID NO: 132

Met Pro Gln Leu Tyr Pro Leu Pro Pro Arg Trp Arg Arg Ala Ala Arg Gln Gly Leu Ala Ala Leu Thr
Leu Ala Thr Thr Ala Leu Gly Ile Ser Thr Ala Gln Ala Gln Ser Ala Pro Arg Thr Ala Phe Val His
Leu Phe Glu Trp Lys Trp Thr Asp Ile Ala Arg Glu Cys Glu Thr Phe Leu Gly Pro Lys Gly Phe Ala
Ala Val Gln Val Ser Pro Pro Asn Glu His Asn Trp Val Thr Ser Gly Asp Gly Ala Pro Tyr Pro Trp
Trp Met Arg Tyr Gln Pro Val Ser Tyr Ser Leu Asp Arg Ser Arg Ser Gly Thr Arg Ala Glu Phe Gln
Asp Met Val Asn Arg Cys Asn Ala Val Gly Val Gly Ile Tyr Val Asp Ala Val Ile Asn His Met Ser
Gly Gly Thr Gly Gly Thr Ser Ser Ala Gly Arg Ser Trp Ser Tyr His Asn Tyr Pro Gly Leu Tyr Gly
Pro Asn Asp Phe His Gln Pro Val Cys Ser Ile Thr Asn Tyr Gly Asp Ala Asn Asn Val Gln Arg Cys
Glu Leu Ser Gly Leu Gln Asp Leu Asp Thr Gly Ser Ala Tyr Val Arg Gly Lys Ile Ala Asp Tyr Leu
Val Asp Leu Val Asn Met Gly Val Lys Gly Phe Arg Val Asp Ala Ala Lys His Ile Ser Pro Thr Asp
Leu Gly Ala Ile Ile Asp Ala Val Asn Ser Arg Thr Gly Ala Asn Arg Pro Phe Trp Phe Leu Glu Val
Ile Gly Ala Ala Gly Glu Ala Val Gln Pro Asn Gln Tyr Phe Ser Leu Gly Gly Gly Gln Val Thr Val
Thr Glu Phe Asn Tyr Gly Lys Gln Ile Phe Gly Lys Phe Ala Gly Gly Gly Arg Leu Ala Glu Leu Arg
Ser Phe Gly Glu Thr Trp Gly Leu Met Pro Ser Ser Lys Ala Ile Ala Phe Ile Asp Asn His Asp Lys
Gln Arg Gly His Gly Gly Gly Gly Asn Tyr Leu Thr Tyr His His Gly Ser Thr Tyr Asp Leu Ala Asn
Ile Phe Met Leu Ala Trp Pro Tyr Gly Tyr Pro Ala Leu Met Ser Ser Tyr Ala Phe Asn Arg Ser Thr
Ala Tyr Asp Thr Ser Phe Gly Pro Pro His Asp Ser Gly Gly Ala Thr Arg Gly Pro Trp Asp Gly Gly
Gly Ser Gln Pro Ala Cys Phe Asn Gln Ser Ile Gly Gly Trp Val Cys Glu His Arg Trp Arg Gly Ile
Ala Asn Met Val Ala Phe Arg Asn Ala Thr Leu Pro Asn Trp Thr Val Thr Asp Trp Trp Asp Asn
Gly Asn Asn Gln Ile Ala Phe Gly Arg Gly Asp Lys Gly Phe Val Val Ile Asn Arg Glu Asp Ala Ala
Leu Thr Arg Asn Phe Lys Thr Ser Leu Pro Ala Gly Gln Tyr Cys Asp Val Ile Ser Gly Asp Phe Asn
Asn Gly Gln Cys Thr Gly His Val Val Thr Val Asp Ala Gly Gly Tyr Val Thr Leu Thr Ala Gly Pro
Asn Gly Ala Ala Ile His Val Gly Ala Arg Leu Asp Gly Ala Ser Gln Pro Pro Thr Thr Ala Ser
Val Thr Phe Asn Ala Ser Ala Asp Thr Phe Trp Gly Gln Asn Leu Phe Val Val Gly Asn His Ser Ala
Leu Gly Asn Trp Ser Pro Ala Ala Ala Arg Pro Met Thr Trp Ile Ser Gly Ser Gly Thr Arg Gly Asn
Trp Arg Ala Val Leu Asn Leu Pro Ala Asn Thr Thr Tyr Gln Tyr Lys Phe Ile Lys Lys Asp Gly Ala
Gly Asn Val Val Trp Glu Gly Gly Gly Asn Arg Val Val Thr Thr Pro Ser Gly Gly Gly Ser Val Ser
Thr Gly Gly Asn Trp Gln

SEQ ID NO: 133

atgaataatgtgaaaaagtatggtgtattattctataattgctaccttagttatttccctttttacacctttttacacagcacaagctaatactgcacctg
tcaacggaacaatgatgcaattttcgaatgggatttaccgaatgatgggacgcttggacgaaagtaaaaaatgaagctaccaatctttctcgtc



Figure 16AAA

aggtattacagcgttatggctccctccagcatataaaggaacgagccaaagc gatgtt ggatatggcgtgtacgatttatatgaccttggggaatt
taatcaaaaaggacgatccgaacgaaatcacggaacaaaagcacaatatattcaagccatccaagctgccaaagccgcaggatgcaagtat
atgcagatgttgatttaatacataaggcgggggctgacggcacagaatttgc gatgcagttgaggtaaaccttctaatacgaaatcaagaacat
ctggcacatatcaaatcaagcatggacaaaatttgatttcttggtcgtggaaacacatactccagcttcaaatggcgctggtatcttttgacggt
accgattgggatgaaagtcgtaaattaaatcgtatttcaaaattccgcggtacaggaaaagcgtgggactgggaagtcgatacagaaaacgga
aactatgattatttaattgttcgctgatttagatatggatcacctgaagttgtgacagagttaaaaaactggggaaaatggtagtaaaatagacaaa
ttagacggatttcgttgatgccgtaaaacataftaaatacagcttttccctgactggctaacaatgtacgtaatacaacaggaaaaaattttt
gctgtgggggaatttggagctatgacgtcaataagctgcataactacattacaaaaaacaatggatcgatgtcgttatttgatgcacctttgcataa
caacttttatatcgcttccaaatcgatggatattttgacatgcgttatttgaataatacattaatgaaagatcaaccttcactcgctgtaacattgt
cgataaccatgatacacaaccaggtaacttttaacatcatgggtagaagcttgggttaaaccgcttgccttacgcctttatttaacaagacaagag
gggtatccttgcgtattttacggtagctattacggaatcccgaatacaatattccgggattaaaaagtaaaatgatccgcttttaattgtcgtcgt
gattatgcttatggaacacaacgtgattacattgatcatcaagacattatcggtaggacacgagaaggcattgatgaaaaccgaactctggactt
gcggcttaattaccgacggccctggcgggaagtaaatggatgtatgtcggtaaaaaacatgctgggaaagtgtttatgatttaactggaaatcga
agtacacagtaaacgattaatgcggacggttggggagaatttaagtaaacggcggtccgttgcatttgggtggctaaaacatcaaacgtca
cattacagtcataaacgccacaacaacagtggaacaaacgtatatgttggcaacattccagagctaggcaattctttg

SEQ ID NO: 134

Met Asn Asn Val Lys Lys Val Trp Leu Tyr Tyr Ser Ile Ile Ala Thr Leu Val Ile Ser Phe Phe Thr Pro
Phe Ser Thr Ala Gln Ala Asn Thr Ala Pro Val Asn Gly Thr Met Met Gln Tyr Phe Glu Trp Asp Leu
Pro Asn Asp Gly Thr Leu Trp Thr Lys Val Lys Asn Glu Ala Thr Asn Leu Ser Ser Leu Gly Ile Thr
Ala Leu Trp Leu Pro Pro Ala Tyr Lys Gly Thr Ser Gln Ser Asp Val Gly Tyr Gly Val Tyr Asp Leu
Tyr Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Ile Arg Thr Lys Tyr Gly Thr Lys Ala Gln Tyr Ile
Gln Ala Ile Gln Ala Ala Lys Ala Ala Gly Met Gln Val Tyr Ala Asp Val Val Phe Asn His Lys Ala
Gly Ala Asp Gly Thr Glu Phe Val Asp Ala Val Glu Val Asn Pro Ser Asn Arg Asn Gln Glu Thr Ser
Gly Thr Tyr Gln Ile Gln Ala Trp Thr Lys Phe Asp Phe Pro Gly Arg Gly Asn Thr Tyr Ser Ser Phe
Lys Trp Arg Trp Tyr His Phe Asp Gly Thr Asp Trp Asp Glu Ser Arg Lys Leu Asn Arg Ile Tyr Lys
Phe Arg Gly Thr Gly Lys Ala Trp Asp Trp Glu Val Asp Thr Glu Asn Gly Asn Tyr Asp Tyr Leu
Met Phe Ala Asp Leu Asp Met Asp His Pro Glu Val Val Thr Glu Leu Lys Asn Trp Gly Lys Trp
Tyr Val Asn Thr Thr Asn Val Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Lys Tyr Ser Phe Phe
Pro Asp Trp Leu Thr Tyr Val Arg Asn Gln Thr Gly Lys Asn Leu Phe Ala Val Gly Glu Phe Trp Ser
Tyr Asp Val Asn Lys Leu His Asn Tyr Ile Thr Lys Thr Asn Gly Ser Met Ser Leu Phe Asp Ala Pro
Leu His Asn Asn Phe Tyr Ile Ala Ser Lys Ser Ser Gly Tyr Phe Asp Met Arg Tyr Leu Leu Asn Asn
Thr Leu Met Lys Asp Gln Pro Ser Leu Ala Val Thr Leu Val Asp Asn His Asp Thr Gln Pro Gly Gln
Ser Leu Gln Ser Trp Val Glu Ala Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu Thr Arg Gln Glu
Gly Tyr Pro Cys Val Phe Tyr Gly Asp Tyr Tyr Gly Ile Pro Lys Tyr Asn Ile Pro Gly Leu Lys Ser
Lys Ile Asp Pro Leu Leu Ile Ala Arg Asp Asp Tyr Ala Tyr Gly Thr Gln Arg Asp Tyr Ile Asp His
Gln Asp Ile Ile Gly Trp Thr Arg Glu Gly Ile Asp Ala Lys Pro Asn Ser Gly Leu Ala Ala Leu Ile Thr
Asp Gly Pro Gly Gly Ser Lys Trp Met Tyr Val Gly Lys Lys His Ala Gly Lys Val Phe Tyr Asp Leu
Thr Gly Asn Arg Ser Asp Thr Val Thr Ile Asn Ala Asp Gly Trp Gly Glu Phe Lys Val Asn Gly Gly
Ser Val Ser Ile Trp Val Ala Lys Thr Ser Asn Val Thr Phe Thr Val Asn Asn Ala Thr Thr Thr Ser
Gly Gln Asn Val Tyr Val Val Gly Asn Ile Pro Glu Leu Gly Asn Ser Leu

SEQ ID NO: 135

gtgacaggcaccccgctttatacattctccacataaaataaccatacagctttcaaatgttgaaatgtataaaaaataaaaaatagtattgtaagc
gttaacatccgtcattataataacttcaaacgcgtttatgtttaatgcaaacggttgatcctcattttatttaagaaaggatgtgtgcatgaattatt
tgaaaaaagtgtggttgattacgctatcgtcgtacctaatacttcttctacgccctttcaactgcacaagccaacactgcaccagtcacg
gaacgatgatgcaatatttcgaatgggatttaccgaatgatggcacactttggacgaaagtaaaaaacgaagcaagcagccttctcttaggtat
tactgcgttatggttaccactgcatacaagggaacgagccaaagggtatggcggtgtacgattgtatgacttaggagaattaatca
aaaagggacgattcgaacgaaatcgaacaaaaacgcaatatttacaagccattcaagcggcgaagcgtggcatgcaagtatacgtg
atgtcgtatttaatacagaaggcgggggcagatagtagaagtggttgacgcagtcgaagtgaatccttcaatcgaaaccaagaaacatctgg



Figure 16BBB

cacatatcaaatcaagcatggacaaaatttgatttccctgaccgtgggaacacatactcaagctttaaattggcgcgtggtatcattttgacggtacg
gattgggatgaaagtcgaaactaaatcgatttacaatttcgtggcacaggaaaagcatgggattgggaagtagacacagagaacggaac
tatgactacttaattgttctgatttagatatggtacacctgaagtcgtgacagagctaaaaaactggggaacatggtacgtcaatacgacaatg
tcgatgggttctgcttagatgcagtaaagcatattaaatagcttttccagattgggttaacatatgtgcgctcacaacacaaaaaatctgtttg
cagtaggagaattttggagctacgatgcaataaactgcataactacattacaaaaacaagtggaaacctgtcgttatttgatgcgccacttcataa
caacttttacactgcttcaaaatctagcgggtattttgacatgcgcgtattgttaaataatacgttgatgaaagaccagccttctcttgcggtcacactc
gttgataatcatgacacgcaaccgggacaatctttacaatcatgggtagagccttggttaagccgcttgcttatgcctttattttgacaagacaaga
aggataccttgctgattttacggcgactattacggcatcctaataacaatttccgggattgaaaagtaaaatcgatccgcttctcattgcccgtgta
gagactacgcatacgaacacaacgtgattatattgacctcaagacattattggatggacacgggaagggaattgactaaaaccggaactctgg
acttgcggcttaattactgacggctcctggtggaagtaaatggatgtatgtagtgtaaaaagcatgctggaaggtgtttacgatctcactggaat
cgaagcgatacggtaacgattaatgcagacggctggggagagtgtaaaagtaaacgggtgctccgtttccatttgggttgccaaaacatcacaa
tcacgtttaccgtcaacaatgcgacaacgacaagcggacaaaatgtgtatgtcgttggaacattccagagctcggaattggaacacagcaaa
cgcaatcaaatgaccccatcttcttccaacgtggaaaacaaccattgctctccacaaggaaaagcaattggcggcgtagccatggccctt
ga

SEQ ID NO: 136

Val Thr Gly Thr Pro Ser Leu Tyr Ile Pro Pro His Lys Ile Thr Ile Gln Leu Ser Asn Leu Leu Lys Cys
Ile Lys Ile Lys Asn Ser Ile Val Ser Val Asn Ile Arg His Tyr Asn Asn Phe Lys Arg Val Tyr Val Leu
Met Gln Thr Phe Ala Ser Ser Phe Tyr Leu Lys Lys Gly Cys Val Cys Met Asn Tyr Leu Lys Lys Val
Trp Leu Tyr Tyr Ala Ile Val Ala Thr Leu Ile Ile Ser Phe Leu Thr Pro Phe Ser Thr Ala Gln Ala Asn
Thr Ala Pro Val Asn Gly Thr Met Met Gln Tyr Phe Glu Trp Asp Leu Pro Asn Asp Gly Thr Leu
Trp Thr Lys Val Lys Asn Glu Ala Ser Ser Leu Ser Ser Leu Gly Ile Thr Ala Leu Trp Leu Pro Pro
Ala Tyr Lys Gly Thr Ser Gln Gly Asp Val Gly Tyr Gly Val Tyr Asp Leu Tyr Asp Leu Gly Glu Phe
Asn Gln Lys Gly Thr Ile Arg Thr Lys Tyr Gly Thr Lys Thr Gln Tyr Leu Gln Ala Ile Gln Ala Ala
Lys Ser Ala Gly Met Gln Val Tyr Ala Asp Val Val Phe Asn His Lys Ala Gly Ala Asp Ser Thr Glu
Trp Val Asp Ala Val Glu Val Asn Pro Ser Asn Arg Asn Gln Glu Thr Ser Gly Thr Tyr Gln Ile Gln
Ala Trp Thr Lys Phe Asp Phe Pro Asp Arg Gly Asn Thr Tyr Ser Ser Phe Lys Trp Arg Trp Tyr His
Phe Asp Gly Thr Asp Trp Asp Glu Ser Arg Lys Leu Asn Arg Ile Tyr Lys Phe Arg Gly Thr Gly Lys
Ala Trp Asp Trp Glu Val Asp Thr Glu Asn Gly Asn Tyr Asp Tyr Leu Met Phe Ala Asp Leu Asp
Met Asp His Pro Glu Val Val Thr Glu Leu Lys Asn Trp Gly Thr Trp Tyr Val Asn Thr Thr Asn Val
Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Lys Tyr Ser Phe Phe Pro Asp Trp Leu Thr Tyr Val
Arg Ser Gln Thr Gln Lys Asn Leu Phe Ala Val Gly Glu Phe Trp Ser Tyr Asp Val Asn Lys Leu His
Asn Tyr Ile Thr Lys Thr Ser Gly Thr Met Ser Leu Phe Asp Ala Pro Leu His Asn Asn Phe Tyr Thr
Ala Ser Lys Ser Ser Gly Tyr Phe Asp Met Arg Tyr Leu Leu Asn Asn Thr Leu Met Lys Asp Gln
Pro Ser Leu Ala Val Thr Leu Val Asp Asn His Asp Thr Gln Pro Gly Gln Ser Leu Gln Ser Trp Val
Glu Pro Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu Thr Arg Gln Glu Gly Tyr Pro Cys Val Phe
Tyr Gly Asp Tyr Tyr Gly Ile Pro Lys Tyr Asn Ile Pro Gly Leu Lys Ser Lys Ile Asp Pro Leu Leu Ile
Ala Arg Arg Asp Tyr Ala Tyr Gly Thr Gln Arg Asp Tyr Ile Asp His Gln Asp Ile Ile Gly Trp Thr
Arg Glu Gly Ile Asp Ser Lys Pro Asn Ser Gly Leu Ala Ala Leu Ile Thr Asp Gly Pro Gly Gly Ser
Lys Trp Met Tyr Val Gly Lys Lys His Ala Gly Lys Val Phe Tyr Asp Leu Thr Gly Asn Arg Ser Asp
Thr Val Thr Ile Asn Ala Asp Gly Trp Gly Glu Phe Lys Val Asn Gly Gly Ser Val Ser Ile Trp Val
Ala Lys Thr Ser Gln Val Thr Phe Thr Val Asn Asn Ala Thr Thr Thr Ser Gly Gln Asn Val Tyr Val
Val Gly Asn Ile Pro Glu Leu Gly Asn Trp Asn Thr Ala Asn Ala Ile Lys Met Thr Pro Ser Ser Tyr
Pro Thr Trp Lys Thr Thr Ile Ala Leu Pro Gln Gly Lys Ala Ile Gly Gly Val Arg His Gly Pro

SEQ ID NO: 137

gtgggacgggagcgttgccgcacactcgaacacttccgcaaggggacatacgggtcacctctgaactgcgtccggatcggccggcgt
ggccggggcggtcgagcttgaagatgtccagcggggagccgccgaggatcacccggcggtgactcgccaggggcggggctcag
cttgaagcgtggcggagccgctccaggagccagacttggaggcccggtatggcggtcgaggaggaggtggccgtcggggctgt
tctcgactggcagacgcgggtctcgaccagcggcggtccttcaggggccgggaaccggcgggccacctcgcccgggcggttccagca



Figure 16CCC

Figure 16 (cont.)

ggggccggggtgatcgtccgctcggccgcccgtgggatcgatgggctcggccgggtgtcgtccgccaccttgaagccgcgggtgctcgttggc
ggggatgccgtagtagatccgctcggcgagatcgaccagaccggagacggccctcctggaagcgcggtgcggcgccggcggtgcccga
agaagaacacctcctggcgggtgttgcggaggaaccgctcaccgatcacgtccgggaacagccggccagccagggaccgcaggcgaag
acgtagaggctggccgcgagagtggagccgtccgaaaggtgaagccgctccaagggccgggaccatggcggcctgccggtactcccc
ggcctcggcctggaacagctccaccacgggtccggcagggcgccggggcgaacagggcgccggttctctctctgtaccagatcgtgcggac
ggcgtcgaaatcgacctgggggaagcggtccgggcctccccctgagacagctcggcgaccggcagccccgcgtctccagaaaaggaa
gggagtcgaggacgtagctgtcgtcctcggcgacatccagaggaccccggtctttgtacagccggtaaccggactggacttcggcgtccc
gccagagctcgaaggagcgggcgacccactccacgtacagacgggtcggttccgtaggcgccgggatgatccgcgtctcggcaccggag
ctggagcgggagtggccggaccccgagcgtccaggaggggtacccgggctccggcgaggagagatgcaggggcgtccagccggcg
aaggcgccggcgccgacgagcgcatatggggatgggagggcatggcgggcgtaaggttatcgagcccgatccttcgtggcatcccat
ctccgaccggagtatcctggaataatcgaagaaggagatcgacatgcaatcgaacggaacgtga

SEQ ID NO: 138

Val Gly Arg Ala Gly Leu Ala His His Ser Asn Thr Ser Ala Lys Gly Thr Tyr Gly Ser Pro Leu Glu
Leu Arg Pro Asp Arg Pro Ala Val Ala Gly Ala Val Glu Leu Glu Asp Val Gln Arg Gly Ala Ala Ala
Glu Asp His Pro Gly Gly Val Leu Ala Gln Gly Gly Ala Gln Leu Glu Ala Val Ala Gly Ala Ala Ser
Gln Glu Pro Asp Val Gly Gly Pro Arg Met Ala Val Glu Glu Glu Val Ala Val Gly Ala Val Leu Val
Leu Ala Asp Ala Gly Leu Asp Gln Arg Arg Val Leu Gln Gly Arg Glu Pro Ala Gly His Leu Gly
Pro Gly Arg Phe Gln Gln Gly Arg Gly Asp Arg Pro Leu Ala Arg Arg Gly Ile Asp Gly Leu Ala Pro
Gly Val Val Arg His Leu Glu Ala Ala Val Leu Val Ala Gly Asp Ala Val Val Asp Pro Leu Ala Glu
Ile Asp Pro Asp Arg Thr Ala Ala Leu Leu Glu Ala Arg Val Ala Arg Arg Arg Ala Glu Glu Glu His
Leu Leu Ala Gly Val Ala Glu Glu Pro Leu Thr Asp His Val Arg Glu Gln Pro Gly Gln Pro Gly Thr
Ala Gly Glu Asp Val Glu Val Gly Arg Glu Ser Gly Ala Val Arg Lys Val Lys Pro Leu Gln Gly Pro
Arg Asp His Gly Gly Leu Pro Val Leu Pro Ala Leu Ala Leu Glu Gln Leu His His Gly Pro Ala Gly
Ala Pro Gly Glu Gln Gly Ala Gly Phe Leu Leu Val Pro Asp Arg Ala Asp Ala Val Glu Ile Asp Leu
Gly Glu Ala Ala Pro Gly Leu Pro Leu Arg Gln Leu Gly Asp Arg Gln Pro Arg Val Leu Gln Lys
Arg Lys Gly Val Ala Asp Val Ala Val Val Leu Ala Ala His Pro Glu Asp Pro Gly Pro Phe Val Gln
Pro Val Thr Gly Leu Asp Phe Gly Val Pro Pro Glu Leu Glu Gly Ala Gly Asp Pro Leu His Val Gln
Thr Val Gly Ser Val Gly Ala Ala Asp Asp Pro Arg Leu Ala Thr Gly Ala Gly Ala Gly Val Pro Arg
Thr Pro Gly Val Gln Glu Gly His Pro Gly Ser Ala Ala Glu Glu Met Gln Gly Gly Pro Ala Ala Glu
Gly Ala Gly Ala Asp Asp Gly Asp Met Gly Met Gly Gly His Gly Gly Arg Lys Val Ile Ala Ala Arg
Ser Phe Ala Gly Ile Pro Ser Pro Thr Gly Val Ser Trp Lys Ile Arg Arg Arg Arg Ser Thr Cys Asn
Arg Thr Glu Thr

SEQ ID NO: 139

atgaaacattcaacctaaacccacactttacctttaactttgctgctgagttcgccggtattggcggcacaaaatggaactatgatgcagttatc
cattgggtatgtgcaaatgacggcgactctggacacaagttgaaacaatgcgccagcactatccgacaacggtttacagcgctgtgtgtgc
caccagcatataaaggcgaggtgtagcaacgacgttggttacggtttacgatatgacttaggggagttgatcaaaaaggatcggtga
cgaactaagtacggcaccaaagaccaatatctaaatgccatcaaagcagcacacaaaaacaatatccaaatttatggtgacgtagtgtcaacca
tcgtggcggtgcagatggcaagtcgtgggtcgataccaagcgtgtggattggaataaccgcaatattgaacttggcgataaatggattgaagca
tgggttgaatttagcttccaggacgtaacgataaatactcagacttcattggacgtggtatcactttgatggcgctgattgggatgacgcaggta
aagagaagcgatcttaaatcaaaaggtgatggtaaagcatgggattgggaagtcagttctgaaaaaggcaactatgactacctatgtacgca
gacttagacatggatcaccagaagtgaaagcaagagctgaagattgggtgaatgggtacttaaacatgacgggtgttgatggcttccgaatgg
atgcagtgaaacatcacaatctgcacaactttatgactaagacttctggcagcatgtcattgttgatgcgctttacatatgaacttataacgct
tgcgctctgttgcaactttgatatgcgccgaatcatggatggcactttgatgaaagacaaccagtgaaagcagtaaacactggttgagaacc
atgatacgcaaccactacagggccttagagtcctcggttgattgggttcaaacacttgcgtacgcgttcattttgcttcgtgaggaaaggttatcc
gtcagttcttacgcagattactacggtgcgaatacagcgataaaggcgacgatacaacatggtgaaagtgcccttacattgagcaattggtga
aagcgcgtaagattatgcttatggtaaacaacattctaccttgaccactgggatgtgattggttgacacgagaagggggatcggaacatccg



Figure 16DDD

aactctatggcgggtatcatgagtgatggctcctggcggacaagtgatgtacacaggttcaccgagcacacgttatgtcgataaactaggatt
cgtaccgaagaagtatggactaacgctagtgatggcgccgaattccagtgaaacggcgatcggttctgttgggttggcgtaaataa

SEQ ID NO: 140

Met Lys Thr Phe Asn Leu Lys Pro Thr Leu Leu Pro Leu Thr Leu Leu Ser Ser Pro Val Leu Ala
Ala Gln Asn Gly Thr Met Met Gln Tyr Phe His Trp Tyr Val Pro Asn Asp Gly Ala Leu Trp Thr Gln
Val Glu Asn Asn Ala Pro Ala Leu Ser Asp Asn Gly Phe Thr Ala Leu Trp Leu Pro Pro Ala Tyr Lys
Gly Ala Gly Gly Ser Asn Asp Val Gly Tyr Gly Val Tyr Asp Met Tyr Asp Leu Gly Glu Phe Asp
Gln Lys Gly Ser Val Arg Thr Lys Tyr Gly Thr Lys Asp Gln Tyr Leu Asn Ala Ile Lys Ala Ala His
Lys Asn Asn Ile Gln Ile Tyr Gly Asp Val Val Phe Asn His Arg Gly Gly Ala Asp Gly Lys Ser Trp
Val Asp Thr Lys Arg Val Asp Trp Asn Asn Arg Asn Ile Glu Leu Gly Asp Lys Trp Ile Glu Ala Trp
Val Glu Phe Ser Phe Pro Gly Arg Asn Asp Lys Tyr Ser Asp Phe His Trp Thr Trp Tyr His Phe Asp
Gly Val Asp Trp Asp Ala Gly Lys Glu Lys Ala Ile Phe Lys Phe Lys Gly Asp Gly Lys Ala Trp
Asp Trp Glu Val Ser Ser Glu Lys Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Leu Asp Met Asp
His Pro Glu Val Lys Gln Glu Leu Lys Asp Trp Gly Glu Trp Tyr Leu Asn Met Thr Gly Val Asp Gly
Phe Arg Met Asp Ala Val Lys His Ile Lys Tyr Gln Tyr Leu Gln Glu Trp Ile Asp Tyr Leu Arg Lys
Lys Thr Gly Lys Glu Leu Phe Thr Val Gly Glu Tyr Trp Asn Tyr Asp Val Asn Asn Leu His Asn
Phe Met Thr Lys Thr Ser Gly Ser Met Ser Leu Phe Asp Ala Pro Leu His Met Asn Phe Tyr Asn Ala
Ser Arg Ser Gly Gly Asn Phe Asp Met Arg Arg Ile Met Asp Gly Thr Leu Met Lys Asp Asn Pro
Val Lys Ala Val Thr Leu Val Glu Asn His Asp Thr Gln Pro Leu Gln Ala Leu Glu Ser Pro Val Asp
Trp Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu Leu Arg Glu Glu Gly Tyr Pro Ser Val Phe Tyr
Ala Asp Tyr Tyr Gly Ala Gln Tyr Ser Asp Lys Gly His Asp Ile Asn Met Val Lys Val Pro Tyr Ile
Glu Gln Leu Val Lys Ala Arg Lys Asp Tyr Ala Tyr Gly Lys Gln His Ser Tyr Leu Asp His Trp Asp
Val Ile Gly Trp Thr Arg Glu Gly Asp Ala Glu His Pro Asn Ser Met Ala Val Ile Met Ser Asp Gly
Pro Gly Gly Thr Lys Trp Met Tyr Thr Gly Ser Pro Ser Thr Arg Tyr Val Asp Lys Leu Gly Ile Arg
Thr Glu Glu Val Trp Thr Asn Ala Ser Gly Trp Ala Glu Phe Pro Val Asn Gly Gly Ser Val Ser Val
Trp Val Gly Val Lys

SEQ ID NO: 141

atgaaccaataaacctactcatatccgcccttgctgtttgtcttcagttccgcgacttacgccgatactatttgcacgcgttaattggaagt
atcagatgtgacggccaacgcgaatcaaatgctcaagctgggtataagaagtgtgttgcgcctgcaatgaaatcagttggcagccaatgg
tgggctcgtatcaacctcaagatctacgcactatcgatttctcttgggcaataaacaagatttagccgcaatgattgccgactcaaaggtgtg
ggcgtcgatgtgtatgccgatgtgtactcaaccatattggcgaatgaaagctggaagcgaagtgactgaattaccctggcacagaagtgtctaa
acgattatgtagccgttcaagctactatgctgaccagactctgttggcaacctagcacaaggttatgtgcagcgaacgacttcatccagcgg
gctgtatttcagattggaacgacctgtgcatgttcagttatggcgttggcgcagatggatgtaggttacctgacctgatccaaacaac
tgggtggttcacaacagcgttgtatctgaaagcgctaaaagatatgggcatcaaaaggttccgaattgatgcagtgaagcacatgagccaata
ccaaatcgtacaggtattcacgtctgaaattactgcgaacatgcattgttgggtgaagtattactagcgggtggagcaggggaatagcggctatg
aatgttcttagcgccttacctgaataatactaatcactctgcctacgattcccgtgttgcacgcattcgtcggcattttctatggggggcggtt
aatcaactgcattgatcctaaagcgtacggcaggtcaggtgatgataatcgtcgcacacatttgcgatcacacatgatattccaaccaatgacgg
cttcgcgtaccaaaattatggaccacaagacgagcagcttgcctacgcgtatctccttgtaaaagacgggtggcacgcgcgtgacatgacgtg
atcttctgattctgaagacaaggataacggcgttggggcaatgttggaaacagttcgacaatgaaaacatgttgagcttccataacgcgatgc
aaggcaaaacatgacgatgtttctagcgaccattgcacttgggttaagcgtggcgaagaaggtgttgggttataacaagtggtggtgaaa
cgcggtggcgtgacgggtgatccatcaacatgagtttaattggcatgttaatacaaaagacgtgtaagcagcgcgaacagaaaccgtgactct
cgttaccatagcttaattaccaccacgcagtgccgtatgtttaagctgtag

SEQ ID NO: 142

Met Lys Pro Ile Asn Thr Leu Leu Ile Ser Ala Leu Ala Val Cys Ser Phe Ser Ser Ala Thr Tyr Ala
Asp Thr Ile Leu His Ala Phe Asn Trp Lys Tyr Ser Asp Val Thr Ala Asn Ala Asn Gln Ile Ala Gln
Ala Gly Tyr Lys Lys Val Leu Val Ala Pro Ala Met Lys Ser Ser Gly Ser Gln Trp Trp Ala Arg Tyr
Gln Pro Gln Asp Leu Arg Thr Ile Asp Ser Pro Leu Gly Asn Lys Gln Asp Leu Ala Ala Met Ile Ala

Figure 16EEE



Ala Leu Lys Gly Val Gly Val Asp Val Tyr Ala Asp Val Val Leu Asn His Met Ala Asn Glu Ser Trp
Lys Arg Ser Asp Leu Asn Tyr Pro Gly Thr Glu Val Leu Asn Asp Tyr Ala Ser Arg Ser Ser Tyr Tyr
Ala Asp Gln Thr Leu Phe Gly Asn Leu Ala Gln Gly Tyr Val Ser Ala Asn Asp Phe His Pro Ala Gly
Cys Ile Ser Asp Trp Asn Asp Pro Gly His Val Gln Tyr Trp Arg Leu Cys Gly Ala Asp Gly Asp Val
Gly Leu Pro Asp Leu Asp Pro Asn Asn Trp Val Val Ser Gln Gln Arg Leu Tyr Leu Lys Ala Leu
Lys Asp Met Gly Ile Lys Gly Phe Arg Ile Asp Ala Val Lys His Met Ser Gln Tyr Gln Ile Asp Gln
Val Phe Thr Ser Glu Ile Thr Ala Asn Met His Val Phe Gly Glu Val Ile Thr Ser Gly Gly Ala Gly
Asn Ser Gly Tyr Glu Ser Phe Leu Ala Pro Tyr Leu Asn Asn Thr Asn His Ser Ala Tyr Asp Phe Pro
Leu Phe Ala Ser Ile Arg Ser Ala Phe Ser Met Gly Gly Gly Leu Asn Gln Leu His Asp Pro Lys Ala
Tyr Gly Gln Ala Leu Asp Asp Asn Arg Ser Ile Thr Phe Ala Ile Thr His Asp Ile Pro Thr Asn Asp
Gly Phe Arg Tyr Gln Ile Met Asp Pro Gln Asp Glu Gln Leu Ala Tyr Ala Tyr Ile Leu Gly Lys Asp
Gly Gly Thr Pro Leu Ile Tyr Ser Asp Asp Leu Pro Asp Ser Glu Asp Lys Asp Asn Gly Arg Trp Gly
Asn Val Trp Asn Ser Ser Thr Met Lys Asn Met Leu Ser Phe His Asn Ala Met Gln Gly Lys Thr
Met Thr Met Ile Ser Ser Asp His Cys Thr Leu Leu Phe Lys Arg Gly Lys Glu Gly Val Val Gly Ile
Asn Lys Cys Gly Glu Thr Arg Gly Val Thr Val Asp Thr Tyr Gln His Glu Phe Asn Trp His Val Gln
Tyr Lys Asp Val Leu Ser Ser Ala Thr Glu Thr Val Thr Ser Arg Tyr His Thr Phe Asn Leu Pro Pro
Arg Ser Ala Arg Met Phe Lys Leu

SEQ ID NO: 143

atgccaaagagcacttttaccaaatccataacaaaatcacttcttgctacttccgttggtaagcttattgcctgcctacgcacaggccgacactat
cttgcacatgctttaactggaatacagcgacattaccgccaagcagagcaaaatgcgcaagctggtataaaaaagtactgattcaccgcccgc
tgaagccacaggcccacaatgggtggcaggttaccacacaggacattcgagtgattgactcccctgtcggcaacaagcaagattacaag
ccctcattgcagccttaaggcacaaggcgttgaagtatacgcagacatcgtactcaaccacatggccaacgaaagctggaacgagacgatc
tgaactacccgggaagtgaattacttaccacaaatagtggttacatgaaccagcaaaaatgtttggagatttagcaaaaatcagtt
ctctgccaatgatttaccggctgctgctgacttactgagtaacccggggcatgttcaactggtcgttatgtgttggaatggtgacact
gggttacctgatcttgatcctaactcgtgggtgatcgaacaaaacgttattacgtgcttgaaagacatgggaataagggttccgagttg
atcggttaaacacatgagcgattaccaaatcaaccaagtgtttacgccagacatcatcgaggttcatgtatttgggtgaagtgaaccagtg
gtggcaaggcagcaatgactaccactctttctggaaccgtatttaataacaccaatcacgccgcgtatgacttcccgtatttgcctctatccg
aatgcatttagttatcatggcagcttctcaattacatgatccacaagcttacgggaagcacttccaaacgacagagccattacttccatca
ctcacgacattccaaccaatgatggttccgttaccacaaatcatggatccaaccagtgaaaaactcgcgtacgcgtacattctaggcaaatggtgg
ggtagccacttatctatagcgtggtttagaccaagtgaagataaagataaggccgctggcgtgatgtatggaaccaagaatacatggttaa
catgatcagcttcacacaaggtgcaaggtaaaagcatggaggtcatgtacagcgatcaatgcttgcgtgctttaaactgtaaaaacaaggct
tagtcggtattaataagtgcgtgaaagccgtacctacaccatagatacccatcgtttgaatttaactggtaccaaccgtacaacgacacattaag
ccagcacagcgagacctttagcagccgttatcatgctctgaccattccggcgcaaacagcacgaatgttggcgctataa

SEQ ID NO: 144

Met Pro Lys Ser Thr Phe Thr Lys Ser Ile Thr Lys Ser Leu Leu Ala Thr Ser Val Val Val Ser Leu
Leu Pro Ala Tyr Ala Gln Ala Asp Thr Ile Leu His Ala Phe Asn Trp Lys Tyr Ser Asp Ile Thr Arg
Gln Ala Glu Gln Ile Ala Gln Ala Gly Tyr Lys Lys Val Leu Ile Ser Pro Pro Leu Lys Ser Thr Gly Pro
Gln Trp Trp Ala Arg Tyr Gln Pro Gln Pro Gln Asp Ile Arg Val Ile Asp Ser Pro Val Gly Asn Lys Gln Asp
Leu Gln Ala Leu Ile Ala Ala Leu Lys Ala Gln Gly Val Glu Val Tyr Ala Asp Ile Val Leu Asn His
Met Ala Asn Glu Ser Trp Lys Arg Asp Asp Leu Asn Tyr Pro Gly Ser Asp Leu Leu Thr Gln Tyr Ser
Gln Asn Met Ala Tyr Met Asn Gln Gln Lys Leu Phe Gly Asp Leu Glu Gln Asn Gln Phe Ser Ala
Asn Asp Phe His Pro Ala Gly Cys Ile Thr Asp Trp Ser Asn Pro Gly His Val Gln Tyr Trp Arg Leu
Cys Gly Gly Asn Gly Asp Thr Gly Leu Pro Asp Leu Asp Pro Asn Ser Trp Val Ile Asp Gln Gln Lys
Arg Tyr Leu Arg Ala Leu Lys Asp Met Gly Ile Lys Gly Phe Arg Val Asp Ala Val Lys His Met Ser
Asp Tyr Gln Ile Asn Gln Val Phe Thr Pro Asp Ile Ile Ala Gly Leu His Val Phe Gly Glu Val Ile Thr
Ser Gly Gly Lys Gly Ser Asn Asp Tyr His Ser Phe Leu Glu Pro Tyr Leu Asn Asn Thr Asn His Ala
Ala Tyr Asp Phe Pro Leu Phe Ala Ser Ile Arg Asn Ala Phe Ser Tyr His Gly Ser Leu Ser Gln Leu
His Asp Pro Gln Ala Tyr Gly Gln Ala Leu Pro Asn Asp Arg Ala Ile Thr Phe Thr Ile Thr His Asp

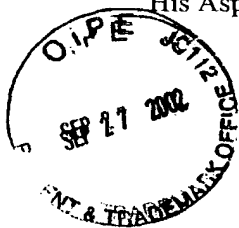


Figure 16FFF

Ile Pro Thr Asn Asp Gly Phe Arg Tyr Gln Ile Met Asp Pro Thr Ser Glu Lys Leu Ala Tyr Ala Tyr
Ile Leu Gly Lys Asp Gly Gly Ser Pro Leu Ile Tyr Ser Asp Ala Leu Asp Pro Ser Glu Asp Lys Asp
Lys Gly Arg Trp Arg Asp Val Trp Asn Gln Glu Tyr Met Val Asn Met Ile Ser Phe His Asn Lys Val
Gln Gly Lys Ser Met Glu Val Met Tyr Ser Asp Gln Cys Leu Leu Val Phe Lys Arg Glu Lys Gln
Gly Leu Val Gly Ile Asn Lys Cys Ala Glu Ser Arg Thr Tyr Thr Ile Asp Thr His Arg Phe Glu Phe
Asn Trp Tyr Gln Pro Tyr Asn Asp Thr Leu Ser Gln His Ser Glu Thr Phe Ser Ser Arg Tyr His Ala
Leu Thr Ile Pro Ala Gln Thr Ala Arg Met Leu Ala Leu

SEQ ID NO: 145

atgttgaaaaggattacggtagctgtgttattatttttgccttttcctaataatatatgggaggaataaggcgggaagcagcaacgataataatgga
acattaatgcagtatgttgagtggtacgctccgaatgatgggaatcattggaatcggttgcgttatgatgctgaaagttagctcataagggaatcac
atctgtatggataccacctgcataaaaggacttcgcaaaatgatgtagggtatggggcctatgattatacgaattaggggagttcaatcaaaaa
ggaacgggtgcggacgaaatatgggacaaaggcacagttgaaatctgcaattgacgctttacataagcaaaacatcgacgtatacgggtgatgta
gttatgaatcataaagggtgggctgattatactgaaaccgtaacagctgttgaggtagaccgtaacaatcgaatatggaatgatcaggtgattatg
aaattagtgctggcaggggttttaactttccaggggcgagagatgcttattcattcaaatggaaatggtatcattttgacggaacggattgggat
gaagggaaggaaattaaaccgaattataaatttaggggtataggtaaagcgtgggactgggaagtgtctagcgaaatggaaattatgattttg
atgtatgcagatcttgattttgatcatccagatgttgcgaatgaaatgaaagttggggaacgtggtatgcgaatgaattaaattgatggatttgc
ttagatgctgttaacatattgatcatgaatatttaccggtattgggtaaatcatgtcagacagcaaacggggaagaaatgtttacgggtgctgaat
attggcaaatgatatccagactttaacaattatttggcgaaagtcaattataatcaatctgtatttgatgcaccgcttcattacaatttcattatgctt
caacaggaaatgggaattatgatatgaaatattttaaattggaacagtaaatgaaaatcatcctgcactgcagttactctcgttgagaatcatga
ttctcaacctgggcaatcattggaatctgtagtaagtcggtgttaagccgctggcatatgcattttttaactcgtgcagagggtatccttcagt
ttttatggtgattactatgggacaagcggaatagtagttatgaaattccagcgttaaaagataaaattgatccaattttgacggcagcaaaaaact
ttgcatatggtacgcagcgtgattatttagaccatccagatgtgattggctggacaagagaaggagatagttacatgctaagctcgtttagcgg
cattaatctccgatggaccaggaggatcaaaagtggatggatgttgaaagaataacgctggggaagtatggtacgatattacgggtaatacaaac
aaatactgtaacaattaataaagatggatcggggcaattccatgtaagtggagctcgtttctatatatgttcaacagtaa

SEQ ID NO: 146

Met Leu Lys Arg Ile Thr Val Val Cys Leu Leu Phe Ile Leu Leu Phe Pro Asn Ile Tyr Gly Arg Asn
Lys Ala Glu Ala Ala Thr Ile Asn Asn Gly Thr Leu Met Gln Tyr Phe Glu Trp Tyr Ala Pro Asn Asp
Gly Asn His Trp Asn Arg Leu Arg Tyr Asp Ala Glu Ser Leu Ala His Lys Gly Ile Thr Ser Val Trp
Ile Pro Pro Ala Tyr Lys Gly Thr Ser Gln Asn Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr Asp Leu
Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr Lys Ala Gln Leu Lys Ser Ala Ile
Asp Ala Leu His Lys Gln Asn Ile Asp Val Tyr Gly Asp Val Val Met Asn His Lys Gly Gly Ala Asp
Tyr Thr Gly Thr Val Thr Ala Val Glu Val Asp Arg Asn Asn Arg Asn Ile Glu Val Ser Gly Asp Tyr
Glu Ile Ser Ala Trp Thr Gly Phe Asn Phe Pro Gly Arg Arg Asp Ala Tyr Ser Asn Phe Lys Trp Lys
Trp Tyr His Phe Asp Gly Thr Asp Trp Asp Gly Gly Arg Lys Leu Asn Arg Ile Tyr Lys Phe Arg Gly
Ile Gly Lys Ala Trp Asp Trp Glu Val Ser Ser Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp
Leu Asp Phe Asp His Pro Asp Val Ala Asn Glu Met Lys Ser Trp Gly Thr Trp Tyr Ala Asn Glu Leu
Asn Leu Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Asp His Glu Tyr Leu Arg Asp Trp Val Asn
His Val Arg Gln Gln Thr Gly Lys Glu Met Phe Thr Val Ala Glu Tyr Trp Gln Asn Asp Ile Gln Thr
Leu Asn Asn Tyr Leu Ala Lys Val Asn Tyr Asn Gln Ser Val Phe Asp Ala Pro Leu His Tyr Asn
Phe His Tyr Ala Ser Thr Gly Asn Gly Asn Tyr Asp Met Arg Asn Ile Leu Asn Gly Thr Val Met Lys
Asn His Pro Ala Leu Ala Val Thr Leu Val Glu Asn His Asp Ser Gln Pro Gly Gln Ser Leu Glu Ser
Val Val Ser Pro Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu Thr Arg Ala Glu Gly Tyr Pro Ser
Val Phe Tyr Gly Asp Tyr Tyr Gly Thr Ser Gly Asn Ser Ser Tyr Glu Ile Pro Ala Leu Lys Asp Lys
Ile Asp Pro Ile Leu Thr Ala Arg Lys Asn Phe Ala Tyr Gly Thr Gln Arg Asp Tyr Leu Asp His Pro
Asp Val Ile Gly Trp Thr Arg Glu Gly Asp Ser Val His Ala Lys Ser Gly Leu Ala Ala Leu Ile Ser
Asp Gly Pro Gly Gly Ser Lys Trp Met Asp Val Gly Lys Asn Asn Ala Gly Glu Val Trp Tyr Asp Ile
Thr Gly Asn Gln Thr Asn Thr Val Thr Ile Asn Lys Asp Gly Ser Gly Gln Phe His Val Ser Gly Gly
Ser Val Ser Ile Tyr Val Gln Gln

Figure 16GGG



SEQ ID NO: 147

atgagcttaaataactttaaggtaaaactgcttagtttgcgtgtcttctgctgtattgtcactggctccaaattagccaatgctgcaaaatttgaag
tgagatgggtgataatccatccgtttcagtgacatatgacaatatgcaaaagagtgtacagagtaccttggtccagccggttgcaggtgtaca
gatttccagccagcggacaataagcgggctgaaggagatgtgtgggcccgtatatcagccggttaattataagaattttacaaccatgaccggta
acgaggagcagcttaaggcaatgatcaagacctgtaatatgacaggtgttaaggtgttcgctgacgctgtttcaacaaaaaggctacagacgg
ttaggctggggcggttcaactggagtataagaactaccctgacggattctccggatcagattccatggagactgttccattgacaaaagctat
actgatgcaataatgtcagaacctgtgcactctcaggtatgccggacgttgccacagataactccgctactcaggaaaagattgcagattacct
cgttctttaatgaatatgggggtctatggttccgtattgacgctgcaaaagcacatgggatacaacgatataactccattcttcaaaaactgcac
agaagactggaagaagacctcctgcatacttggaagtaatcggagccggtaacgaagctgccgacattcagccggacaaagtatactttattga
gaatgcggttgtaactgacttcggttatgtctgggatgcaaatgagagtttcggaaaaggtaattacggtaaggcactggaactcagtacgtggct
cggtgcaaatcagaacattcgtaaacaatcatgatgatgaatggggcagatgctcagccggttagctgctcaatgaaaactcagaattatgctg
attataatctggctcagtcctggctgtgtatggcctgtaggtacagtaagacagatatattccggttattcattccctgtaaaagataatgactcta
tcgctcagtgatgcaactcatgatcagggcgggcctcttggtgccgaccgctgtgaaggtggctggtgtgtcagcaccgtgtgtccttcgttct
caattcccaagatttgcgagagctaccagaggtactgctgtatcaaccaagggatttgacaatggtgcttgggttaacagaggaagcaaaag
gttttatgcacagaatactaccaacagtcctataaccagacattctctgttgaaagtacctgacggaaattactgtgatatcttaggaacatcagat
cctaagagcaatccatgcggagcagacgttgcgtaagcggcgtaaggctacctttactattctgcaaaagacagctgtggctatctgtacaga
ctcagactggtgcggcaagggggtgatcctgtgaaagtgtaccgaccggtgctgctgtgtttgtaaggggaaaccaccgtaaatggtgtgt
gcgtcagctggtgtaatgcgcatcatcaaatgaggaatgcacctgtgtattgaatccgaatgatccaactgtcaggctgatattgaacctacca
agggtaaacctctgttacccggtacttcaaacgggtggaacaggatcctttaacatataaccgtaaaacagggttctggactattaatctgactctt
gacggtgcaggtgataccagcggagctcagcgttcaaggttacagacggatgttcattgaccgggaacagtttacggttcttcaggtactgccg
gaaagttggatgtaatacatcatcaaccggcgatgaacctgtgtctctgttggtgattatgttcttccattaacgataagaccatggaatatacat
tcaccaaggcagatgaagtaactaatcagccaccggttgcatcttaccgcgacagttaacggcttgaccgttcttttgccaataattcatccga
ccctgagaatgatgaattaacctacagctggaatttcggtaatggttaaacaatcatccgagaaagctcctagcataacctatgaagaatccggtg
agtatactgttactttaaaggttactgattcagctaataaactgatacttactaaagataactgtaacagcaccctctagtggcaagtacttaaa
gggtgcagtcagagggttcgatgataattacggaactgatctgttaaccaagaacgggttctgattggaccggcgtcttgaattcttggatccacta
gtgtcgacctgcagggcgcgagctc

SEQ ID NO: 148

Met Ser Leu Asn Asn Phe Lys Val Lys Leu Leu Ser Phe Ala Val Ser Ser Ala Val Leu Ser Leu Ala
Pro Asn Leu Ala Asn Ala Ala Asn Phe Glu Ser Glu Met Val Ile Ile His Pro Phe Gln Trp Thr Tyr
Asp Asn Ile Ala Lys Glu Cys Thr Glu Tyr Leu Gly Pro Ala Gly Phe Asp Gly Val Gln Ile Ser Gln
Pro Ala Glu His Lys Arg Ala Glu Gly Val Trp Trp Ala Val Tyr Gln Pro Val Asn Tyr Lys Asn Phe
Thr Thr Met Thr Gly Asn Glu Glu Gln Leu Lys Ala Met Ile Lys Thr Cys Asn Asp Ala Gly Val Lys
Val Phe Ala Asp Ala Val Phe Asn Gln Lys Ala Thr Asp Gly Val Gly Trp Gly Gly Ser Thr Trp Ser
Tyr Lys Asn Tyr Pro Asp Gly Phe Ser Gly Ser Asp Phe His Gly Asp Cys Ser Ile Asp Lys Ser Tyr
Thr Asp Ala Asn Asn Val Arg Thr Cys Ala Leu Ser Gly Met Pro Asp Val Ala Thr Asp Asn Ser Ala
Thr Gln Glu Lys Ile Ala Asp Tyr Leu Ala Ser Leu Met Asn Met Gly Val Tyr Gly Phe Arg Ile Asp
Ala Ala Lys His Met Gly Tyr Asn Asp Ile Asn Ser Ile Leu Ser Lys Thr Ala Gln Lys Thr Gly Arg
Arg Pro Pro Ala Tyr Leu Glu Val Ile Gly Ala Gly Asn Glu Ala Ala Asp Ile Gln Pro Asp Lys Tyr
Thr Phe Ile Glu Asn Ala Val Val Thr Asp Phe Gly Tyr Val Trp Asp Ala Asn Glu Ser Phe Gly Lys
Gly Asn Tyr Gly Lys Ala Leu Glu Leu Ser Thr Trp Leu Gly Ala Asn Ser Glu Thr Phe Val Asn Asn
His Asp Asp Glu Trp Gly Arg Cys Ser Ala Gly Ser Cys Ser Met Lys Thr Gln Asn Tyr Ala Asp Tyr
Asn Leu Ala Gln Ser Trp Leu Ala Val Trp Pro Val Gly Thr Val Arg Gln Ile Tyr Ser Gly Tyr Ser
Phe Pro Val Lys Asp Asn Asp Pro Tyr Arg Val Ser Asp Ala Thr His Asp Gln Gly Gly Pro Leu Gly
Ala Asp Arg Cys Glu Gly Gly Trp Leu Cys Gln His Arg Val Ser Phe Val Leu Asn Ser Pro Arg Phe
Ala Arg Ala Thr Arg Gly Thr Ala Val Ser Thr Lys Gly Phe Asp Asn Gly Ala Leu Trp Phe Asn Arg
Gly Ser Lys Gly Phe Tyr Ala Gln Asn Thr Thr Asn Ser Pro Ile Thr Gln Thr Phe Ser Val Glu Val
Pro Asp Gly Asn Tyr Cys Asp Ile Leu Gly Thr Ser Asp Pro Lys Ser Asn Pro Cys Gly Ala Asp Val
Val Val Ser Gly Gly Lys Ala Thr Phe Thr Ile Pro Ala Lys Thr Ala Val Ala Ile Cys Thr Asp Ser



Figure 16HHH

Applicant(s): Walter Callen et al.
ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

Asp Trp Cys Gly Lys Gly Val Asp Pro Cys Glu Ser Asp Pro Thr Gly Ala Ala Cys Val Cys Lys Gly
Glu Thr Thr Val Asn Gly Val Cys Val Ser Trp Cys Asn Ala His Ser Ser Asn Glu Glu Cys Thr Cys
Val Leu Asn Pro Asn Asp Ala Asn Cys Gln Ala Asp Ile Glu Pro Thr Lys Gly Lys Leu Cys Tyr Ala
Gly Thr Ser Asn Gly Trp Lys Gln Asp Pro Leu Thr Tyr Asn Arg Lys Thr Gly Phe Trp Thr Ile Asn
Leu Thr Leu Asp Gly Ala Gly Asp Thr Ser Gly Ala Gln Arg Phe Lys Val Thr Asp Gly Cys Ser Trp
Thr Gly Thr Val Tyr Gly Ser Ser Gly Thr Ala Gly Lys Leu Asp Val Asn Thr Ser Ser Thr Gly Asp
Glu Pro Val Ser Leu Val Gly Asp Tyr Val Leu Ser Ile Asn Asp Lys Thr Met Glu Tyr Thr Phe Thr
Lys Ala Asp Glu Val Thr Asn Gln Pro Pro Val Ala Ser Phe Thr Ala Thr Val Asn Gly Leu Thr Val
Ser Phe Ala Asn Asn Ser Ser Asp Pro Glu Asn Asp Glu Leu Thr Tyr Ser Trp Asn Phe Gly Asn Gly
Lys Thr Ser Ser Glu Lys Ala Pro Ser Ile Thr Tyr Glu Glu Ser Gly Lys Tyr Thr Val Thr Leu Lys
Val Thr Asp Ser Ala Asn Asn Thr Asp Thr Phe Thr Lys Asp Ile Thr Val Thr Ala Pro Ser Ser Gly
Lys Tyr Leu Lys Val Ala Val Arg Gly Ser His Asp Asn Tyr Gly Thr Asp Leu Leu Thr Lys Asn Gly
Ser Asp Trp Thr Gly Val Phe Glu Phe Phe Gly Ser Thr Ser Val Asp Leu Gln Ala Arg Glu Leu

SEQ ID NO: 149

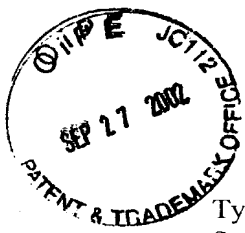
atgatcctaagtaattttaaggtaaacttcttagttttgctgtgtcttctgctgtactgacactggcgtgcaaatgtcgccaatgccagaattatgaaa
gtgaaatgggtattattcatccatttcagtgacatgatgacaatagcaaaagaatgtactgagtatctgggacctgcgggattgacggggtgca
gatttccaggcgggtgagcataaagatgccgggtggtgcatggtgggtacaccagcctgtaaactcaagagtttactaccatggttggtta
atgaagaacagcttagcaatgattaaacctgtaacgagcgaggtgtaaggtcttggcagtgccgtgattaatcagaaagccggcgacgg
ttaggtataggtggttaacttccgaaattataattatcctgacggatttaccagtgatgatttcatcataataactgcagtataggttaataatt
cagatgcatgggtagtaagattctgtgacctcagtgccatgccgatagcaactgataacgacagtaccagaaataagattgctgattacttcg
ccagccttatgaatatgggggtataccgattccgtattgatgctgccaagcacttttagctatgatgatatagacgctattgtagagaaaacagcaa
ccaaagcaggcaggagacctcctgtctatatggaggttatcggaatccgggtcaagaggcggatgatataccagccgaacaagtatacatgga
ttgataatgccgttgaacagattttacttatgctaatagcagcataatattttaacggaaagcgggttatgccaaggccttgaacatggggcgtagggc
atgttgatgctgaaaaatgccgaagtctttataagtaaatcatgataatgaatggggaagaaagctgcccgttctgtctcaataagaaccagaata
atccggattaccatctggctcagtcctggctcgagtttggccttttaggcaagggttagacagatttctgcataatcagttcccggtcttgaagata
gttgtagcgggctcagtcagcaagcccatgatcaggcggtcctatcggggcagcccgtgtgaaggtggtggtgtgtagcaccgtgtac
cgtttgtgctcaattcctagatttgaagagcaaccagagggacagtcgttactactaaagggtttgatgacggagccttgtggttaacagagg
aagcaagggtcttatgccagaataactaccggcagttctataactcattcagttgaattacctgatgaaattactgtatgataccttggag
caaccgatccgaagaataactcctgaggagcggtatgactgtaagcggaggtgaaagcaacctttaccattccggcaagaccgccgtagcta
tctgtactgatgaaaagtgggtgtggcaaggggttgacctgtgaaagcgatcctaccggttccgctgtgtatgtaaggggtgaaaccacagt
aacggcgtatgtgtaagctgggtgaatgctcactcatctaatgaagaatgtcctgtgtgctaaatcctaatgacgctgagtgtagccgacatt
gagccgaccaagggtgaaactctgctatgtaggtacctccaacaagtggactcaggaacctttaacctataatcgcaagaccggttctggactct
caacgttgaaactgacggtgaaggggataaccagcggggcgagcgctttaaagtaccgacggctgttcagtcagggttactgtttacgggtca
tcaggagtagaaggcagacttgacgtaatacttcagccaccggagatgaaccggttctactgacaggtaaatatgttcttccataaatgataag
accatggaatacacattcattcctgcaggcagtggaacaagcctccggttgcgtcatttactccgactgttaaagatctgactgtatctttgtcaa
taattcatccgacctgagaatgatgaattaacctacagctggaatttcggttaacggtaaaacctcatctgaaaaaatccgagtggttacatgat
aaagccggttaataactgtttactcaaaagtaaccgatactgcaaacacactgataccaaacactggaaatcgatttaacatcctgttaacg
gaaaatattccaagggtgagtcagaggttcacatgataactacggaacaaatctgttaaccaggaatggttcagaatggaccggtatcttgaat
cagtaagacaacaaattcaagcttgaagctctgctcctgcagctgaccagtgatcttctcggcggtatcagaggtgaggcattgactgcct
ccggtggatttatcttctcctgcgggaaggtataactataaagttaatgaggaaagcaaggttcttactgcaggcgatgttgactgcaccggg

SEQ ID NO: 150

Met Ile Leu Ser Asn Phe Lys Val Lys Leu Leu Ser Phe Ala Val Ser Ser Ala Val Leu Thr Leu Ala
Ala Asn Val Ala Asn Ala Lys Asn Tyr Glu Ser Glu Met Val Ile Ile His Pro Phe Gln Trp Thr Tyr
Asp Asn Ile Ala Lys Glu Cys Thr Glu Tyr Leu Gly Pro Ala Gly Phe Asp Gly Val Gln Ile Ser Gln
Ala Ala Glu His Lys Asp Ala Gly Gly Ala Trp Trp Gly Thr Tyr Gln Pro Val Asn Phe Lys Ser Phe
Thr Thr Met Val Gly Asn Glu Glu Gln Leu Arg Ala Met Ile Lys Thr Cys Asn Glu Ala Gly Val Lys
Val Phe Ala Asp Ala Val Ile Asn Gln Lys Ala Gly Asp Gly Val Gly Ile Gly Gly Ser Thr Phe Gly
Asn Tyr Asn Tyr Pro Asp Gly Phe Thr Ser Asp Asp Phe His His Asn Asn Cys Ser Ile Gly Asn Asn



Figure 16III



Tyr Ser Asp Ala Trp Val Val Arg Phe Cys Asp Leu Ser Gly Met Pro Asp Ile Ala Thr Asp Asn Asp
Ser Thr Arg Asn Lys Ile Ala Asp Tyr Phe Ala Ser Leu Met Asn Met Gly Val Tyr Gly Phe Arg Ile
Asp Ala Ala Lys His Phe Ser Tyr Asp Asp Ile Asp Ala Ile Val Glu Lys Thr Ala Thr Lys Ala Gly
Arg Arg Pro Pro Val Tyr Met Glu Val Ile Gly Asn Pro Gly Gln Glu Ala Asp Asp Ile Gln Pro Asn
Lys Tyr Thr Trp Ile Asp Asn Ala Val Val Thr Asp Phe Thr Tyr Ala Asn Ser Met His Asn Ile Phe
Asn Gly Ser Gly Tyr Ala Lys Ala Leu Asn Met Gly Leu Gly His Val Asp Ala Glu Asn Ala Glu Val
Phe Ile Ser Asn His Asp Asn Glu Trp Gly Arg Lys Ser Ala Gly Ser Cys Ser Ile Arg Thr Gln Asn
Asn Pro Asp Tyr His Leu Ala Gln Ser Trp Leu Ala Val Trp Pro Leu Gly Lys Val Arg Gln Ile Tyr
Ser Ala Tyr Gln Phe Pro Val Phe Glu Asp Ser Cys Glu Arg Val Ser Gln Gln Ala His Asp Gln Gly
Gly Pro Ile Gly Ala Ala Arg Cys Glu Gly Gly Trp Leu Cys Gln His Arg Val Pro Phe Val Leu Asn
Ser Pro Arg Phe Ala Arg Ala Thr Arg Gly Thr Val Val Thr Thr Lys Gly Phe Asp Asp Gly Ala Leu
Trp Phe Asn Arg Gly Ser Lys Gly Phe Tyr Ala Gln Asn Thr Thr Gly Ser Ser Ile Thr His Thr Phe
Ser Val Glu Leu Pro Asp Gly Asn Tyr Cys Asp Ile Leu Gly Ala Thr Asp Pro Lys Asn Asn Pro Cys
Gly Ala Asp Val Thr Val Ser Gly Gly Lys Ala Thr Phe Thr Ile Pro Ala Lys Thr Ala Val Ala Ile
Cys Thr Asp Glu Lys Trp Cys Gly Lys Gly Val Asp Pro Cys Glu Ser Asp Pro Thr Gly Ser Ala Cys
Val Cys Lys Gly Glu Thr Thr Val Asn Gly Val Cys Val Ser Trp Cys Asn Ala His Ser Ser Asn Glu
Glu Cys Ala Cys Val Leu Asn Pro Asn Asp Ala Glu Cys Gln Ala Asp Ile Glu Pro Thr Lys Gly Lys
Leu Cys Tyr Val Gly Thr Ser Asn Lys Trp Thr Gln Glu Pro Leu Thr Tyr Asn Arg Lys Thr Gly Phe
Trp Thr Leu Asn Val Glu Leu Asp Gly Lys Gly Asp Thr Ser Gly Ala Gln Arg Phe Lys Val Thr
Asp Gly Cys Ser Trp Gln Gly Thr Val Tyr Gly Ser Ser Gly Val Glu Gly Arg Leu Asp Val Asn Thr
Ser Ala Thr Gly Asp Glu Pro Val Ser Leu Thr Gly Lys Tyr Val Leu Ser Ile Asn Asp Lys Thr Met
Glu Tyr Thr Phe Ile Pro Ala Gly Ser Gly Asn Lys Pro Pro Val Ala Ser Phe Thr Pro Thr Val Lys
Asp Leu Thr Val Ser Phe Val Asn Asn Ser Ser Asp Pro Glu Asn Asp Glu Leu Thr Tyr Ser Trp Asn
Phe Gly Asn Gly Lys Thr Ser Ser Glu Lys Asn Pro Ser Val Thr Tyr Asp Lys Ala Gly Lys Tyr Thr
Val Ser Leu Lys Val Thr Asp Thr Ala Asn Asn Thr Asp Thr Lys Thr Leu Glu Ile Asp Leu Thr Ser
Pro Val Asn Gly Lys Tyr Ser Lys Val Ala Val Arg Gly Ser His Asp Asn Tyr Gly Thr Asn Leu Leu
Thr Arg Asn Gly Ser Glu Trp Thr Gly Ile Phe Glu Phe Ser Lys Thr Thr Lys Phe Lys Leu Glu Ala
Leu Pro Pro Ala Ala Asp Gln Cys Ile Phe Leu Gly Gly Asn Arg Gly Glu Ala Leu Thr Ala Ser Gly
Gly Phe Ile Ser Leu Pro Ala Gly Arg Tyr Thr Ile Lys Phe Asn Glu Glu Ser Lys Val Leu Thr Ala
Gly Asp Val Asp Cys Thr Gly

SEQ ID NO: 151

atgaaactattcttcaacaatcatggtgatggcggctgaggctgccaccaccgtagaggctcaaggctggccggaaaactacggcggcgtc
atgttcaggggattctactgggattcctattcagccaccaagtggaactgaagcacaggctgacgagatctgcaactatttctcgttgga
tggttaccacagtcggcctataccggcagcagctacccatgggctacgacccgctgtattactcgaccagcattcatcgttcggcaccgaag
agcagctacggctgttcacgtacctaacaagcagaaggaactggcatcatagccgatgtagtgtcaatcaccgaaagaatgtctaaactg
ggttgatttccggccgagacctacaacgggtgaacctatcagatggtaagcaccgacatcgttcgaacgatgacggcggaaaaacagcca
cttgggcaaatcaaaacggctacgtctctctccaatgccgacgaaggcgaaggctgggacggcatgcgcgacctggaccacaagtcgca
gaacgtgcagaaatcggttcttgctacaccaaatactggttgacgacttaggctataccggattccgctacgatattgtaaaaggatttgacgg
atcgcatgtagccgactacaacaccaatgccggcgtgcagttctctgctggcgaatttgggacggcactgcatcgaagtgttacagttggatca
acagcaccaaaaagagcgatgtgcccagtcggcagccttcgacttcgcttccgatacacctggccgcatgcccgtcaacaacaagaactgg
gcgaacctgaagaacacttccggtatcagcgatgccgattacaggcgctattcgggtacgttggtaaaatcacgatacggaaatcagctcagct
acggcttcccaggatcccatcaagggtgatacgggtgcccctcaatgcctggatgtcggctatgccgggcacacctgtgtttctgaaacattgg
accgactgaagggaagagatcaagaatctcatcgaggcacgtcgcttggtcgttattacaaccagagcacctatgccgaatggatgagcgg
tgacgctacatcggacgtaccgtaacaggtacgaacggcaccttacgtgttctgtgcggctcttatcagtataatgtagccgccaactacattca
gattctcagggcaaaaaactataaatactacgtactcaacacgctcgaggctccctggatcgggaaagggtccggctcgtacaccgaaggtgaa
accgtaaccggttccgctcatcgccatcggccgatgccaatgccaaagctggtatataccaccgacggcacagaccccacccaacccaaca
ggcgttaaccagcggaactgaccatcctcggacggcgcgtctgaagggttggtctgcttccggcggcatcgtcagggaacatacagagc
cgtaattcaccttcagggtgcaaacacctccgagtattacacagccaccatgcacgtatgaaccagtcggagctctcaatccgctgtttgc
ctatgtttgggcaggaccggacaacgagcagattaacggcaactggccgggacccaagctcaccgctaccattaccgaaacaaccttacct

Figure 16JJJ



gggtacacgcagtcgttccgattccgaagaacgtggactatgtcgtgaactttgtttaccacaaaccggcggtacgcagacagtggatgtt
accggcatgaaggccgatgtctgttacattattaacagtaccaagagcggaacaagtacacggtaccgacgttacctcacagtattcttcgtt
agaggccatctttgatgaagaaaactccggctccttcctgtctatgacctgcaggagcgccgctcagcgaaattagaacaggacaattatat
cttcagaacggaaagaagatactatcagataaacagagggtccgaaccattctcctattatgaaatcagacacttagtaatctcagcactgctg
ggtttggggggctgttacaccatcagctgctcctcgtcggg

SEQ ID NO: 152

Met Lys Thr Ile Leu Ser Thr Ile Met Val Met Ala Ala Ala Ala Thr Thr Val Glu Ala Gln Gly
Trp Pro Glu Asn Tyr Gly Gly Val Met Leu Gln Gly Phe Tyr Trp Asp Ser Tyr Ser Ala Thr Lys Trp
Thr Lys Leu Glu Ala Gln Ala Asp Glu Ile Cys Asn Tyr Phe Ser Leu Val Trp Val Pro Gln Ser Ala
Tyr Thr Gly Ser Ser Thr Ser Met Gly Tyr Asp Pro Leu Tyr Tyr Phe Asp Gln His Ser Ser Phe Gly
Thr Glu Glu Gln Leu Arg Ser Phe Ile Ser Thr Tyr Lys Gln Lys Gly Thr Gly Ile Ile Ala Asp Val Val
Val Asn His Arg Lys Asn Val Ser Asn Trp Val Asp Phe Pro Ala Glu Thr Tyr Asn Gly Val Thr Tyr
Gln Met Val Ser Thr Asp Ile Val Ser Asn Asp Asp Gly Gly Lys Thr Ala Thr Trp Ala Asn Gln Asn
Gly Tyr Ser Leu Ser Ser Asn Ala Asp Glu Gly Glu Gly Trp Asp Gly Met Arg Asp Leu Asp His
Lys Ser Gln Asn Val Gln Lys Ser Val Leu Ala Tyr Thr Lys Tyr Leu Val Asp Asp Leu Gly Tyr Thr
Gly Phe Arg Tyr Asp Met Val Lys Gly Phe Asp Gly Ser His Val Ala Asp Tyr Asn Thr Asn Ala
Gly Val Gln Phe Ser Val Gly Glu Tyr Trp Asp Gly Thr Ala Ser Lys Val Tyr Ser Trp Ile Asn Ser
Thr Lys Lys Ser Asp Val Pro Gln Ser Ala Ala Phe Asp Phe Ala Phe Arg Tyr Thr Cys Arg Asp Ala
Val Asn Asn Lys Asn Trp Ala Asn Leu Lys Asn Thr Ser Gly Ile Ser Asp Ala Asp Tyr Arg Arg Tyr
Ser Val Thr Phe Val Glu Asn His Asp Thr Glu Tyr Arg Ser Ala Thr Ala Ser Gln Asp Pro Ile Lys
Gly Asp Thr Val Ala Leu Asn Ala Trp Met Leu Ala Met Pro Gly Thr Pro Cys Val Phe Leu Lys His
Trp Thr Asp Cys Lys Glu Glu Ile Lys Asn Leu Ile Glu Ala Arg Arg Leu Val Gly Ile His Asn Gln
Ser Thr Tyr Ala Glu Trp Met Ser Gly Ala Ala Tyr Ile Gly Arg Thr Val Thr Gly Thr Asn Gly Thr
Leu Arg Val Leu Cys Gly Ser Tyr Gln Tyr Asn Val Ala Ala Asn Tyr Ile Gln Ile Leu Ser Gly Lys
Asn Tyr Lys Tyr Tyr Val Leu Asn Thr Leu Glu Ala Pro Trp Ile Gly Lys Gly Ser Gly Ser Tyr Thr
Glu Gly Glu Thr Val Thr Val Pro Leu Ile Ala Ile Ser Ala Asp Ala Asn Ala Lys Leu Val Tyr Thr
Thr Asp Gly Thr Asp Pro Thr Ala Thr Ser Thr Ala Val Thr Ser Gly Thr Glu Leu Thr Ile Thr Ser
Asp Ala Val Leu Lys Val Gly Leu Leu Ser Gly Gly Ile Val Arg Asn Ile Gln Ser Arg Thr Phe Thr
Phe Gln Ala Ala Asn Thr Ser Glu Tyr Tyr Thr Ala Thr Met His Val Cys Asn Gln Ser Gly Ala Leu
Asn Pro Leu Phe Ala Tyr Val Trp Ala Gly Pro Asp Asn Glu Gln Ile Asn Gly Asn Trp Pro Gly Thr
Lys Leu Thr Ala Thr Ile Thr Glu Asn Asn Leu Thr Trp Tyr Thr Gln Ser Phe Gln Ile Pro Lys Asn
Val Asp Tyr Val Val Asn Phe Val Phe Thr Thr Thr Gly Gly Gly Thr Gln Thr Val Asp Val Thr Gly
Met Lys Ala Asp Val Trp Tyr Ile Ile Asn Ser Thr Lys Ser Gly Asn Lys Tyr Thr Val Thr Asp Val
Thr Ser Gln Tyr Ser Ser Leu Glu Ala Ile Phe Asp Glu Glu Asn Ser Gly Ser Phe Pro Val Tyr Asp
Leu Gln Gly Arg Arg Val Ser Glu Ile Arg Asn Arg Thr Ile Ile Ser Ser Glu Arg Lys Glu Asp Thr
His Gln Ile Asn Arg Gly Ser Glu Pro Phe Ser Tyr Tyr Glu Asn Gln Thr Leu Ser Asn Leu Ser Thr
Ala Gly Phe Gly Gly Leu Val His His Gln Leu Leu Leu Val Gly

SEQ ID NO: 69

atgttgaaggattacggtagtctgtttattgtttatttgccttttctaataatatatagaggaaataaggcagaagcagcaacagtgaacaatgga
acattaatgcagtatgttgagtggtacgctccgaatgatgggaatcattggaatcgtttgcgttcgatgctgaaagttagctcataaaggaaatcac
atctgtatggataccacctgcataaaagggaacttcgcaaaatgatgtagggtatggggcctatgatttatatgatttaggggagttcaatcaaaaa
ggaacgggtgcggacgaaatagggaacaaagcacagttgaaatctgcaattgacgcttacataagcaaaacatcgacgtatacgggtgatgtga
ttatgaatcataaagggtggggctgattatactgaaaccgttaacagctgttgaggtagaccgtaacaatcgaaatattgaagtacaggtgattatca
aattagtgcacgggggttaatttccaggggcggagatgcttatttctaatttcaaatgggaatgggtatcattttgacggaacggatgggatg
aagggaaggaaataaatacgaattataaaatttaggggttagataaagcgtgggattgggaagtgtctagcgaaataggaaattatgattattgat
gtatgcagatcttgattttgatcatcctgatgttgcaatgatgataaattggggaacatggatgcgaatgaattaaattagatggctttcgttt
ggacgctgttaaacatattgatcatgaataattacgcgattgggttaaatacatgccagacagcaaacggggaagaaatgtttacagtagctgaata
ttggcaaatgatgttcaggctttaacaattatttagcgaaagtcaattataatcaatctgtttgatgcaccgcttcattacaatttcattatgcttc

Figure 16KKK

aacaggaaatgggaattatgatatgagaaa*attttaaatggaacagtaatgaaaaatcaccctgcactcgcagtactctcgttgagaatcatgat
tctcagcctgggcagtcattggaatctgtagtaagtccgtggttaagccgctggcatatgcattttttaactcgtgcagagggcgtatccttcagtt
ttctatggtgattactatgggacaagcggaaatagtagttatgaaattccagcgttaaaagataaaattgatccaattttgacggcacgaaaaaactt
tgcataatggtacgcagcgtgattatttagaccatccagatgtgattggctggacaagagaaggcgatgggtgtacatgctaattctggtttagcgac
attactctcgacggaccaggagatcaaagtggatggatgttgaaagaataacgctggggaagtatgtgtacgatattacgggtaatacaaac
aaatactgtaacaattaataaggacggatgggggcagttctatgtaagtggcggtcagttccatataatgttcagcggttaa

SEQ ID NO: 70

Met Leu Lys Arg Ile Thr Val Val Cys Leu Leu Phe Ile Leu Leu Phe Pro Asn Ile Tyr Glu Gly Asn
Lys Ala Glu Ala Ala Thr Val Asn Asn Gly Thr Leu Met Gln Tyr Phe Glu Trp Tyr Ala Pro Asn Asp
Gly Asn His Trp Asn Arg Leu Arg Ser Asp Ala Glu Ser Leu Ala His Lys Gly Ile Thr Ser Val Trp
Ile Pro Pro Ala Tyr Lys Gly Thr Ser Gln Asn Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr Asp Leu
Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr Lys Ala Gln Leu Lys Ser Ala Ile
Asp Ala Leu His Lys Gln Asn Ile Asp Val Tyr Gly Asp Val Val Met Asn His Lys Gly Gly Ala Asp
Tyr Thr Glu Thr Val Thr Ala Val Glu Val Asp Arg Asn Asn Arg Asn Ile Glu Val Ser Gly Asp Tyr
Gln Ile Ser Ala Trp Thr Gly Phe Asn Phe Pro Gly Arg Gly Asp Ala Tyr Ser Asn Phe Lys Trp Lys
Trp Tyr His Phe Asp Gly Thr Asp Trp Asp Glu Gly Arg Lys Leu Asn Arg Ile Tyr Lys Phe Arg Gly
Val Asp Lys Ala Trp Asp Trp Glu Val Ser Ser Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp
Leu Asp Phe Asp His Pro Asp Val Ala Asn Glu Met Lys Asn Trp Gly Thr Trp Tyr Ala Asn Glu
Leu Asn Leu Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Asp His Glu Tyr Leu Arg Asp Trp Val
Asn His Ala Arg Gln Gln Thr Gly Lys Glu Met Phe Thr Val Ala Glu Tyr Trp Gln Asn Asp Val Gln
Ala Leu Asn Asn Tyr Leu Ala Lys Val Asn Tyr Asn Gln Ser Val Phe Asp Ala Pro Leu His Tyr Asn
Phe His Tyr Ala Ser Thr Gly Asn Gly Asn Tyr Asp Met Arg Asn Ile Leu Asn Gly Thr Val Met Lys
Asn His Pro Ala Leu Ala Val Thr Leu Val Glu Asn His Asp Ser Gln Pro Gly Gln Ser Leu Glu Ser
Val Val Ser Pro Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu Thr Arg Ala Glu Gly Tyr Pro Ser
Val Phe Tyr Gly Asp Tyr Tyr Gly Thr Ser Gly Asn Ser Ser Tyr Glu Ile Pro Ala Leu Lys Asp Lys
Ile Asp Pro Ile Leu Thr Ala Arg Lys Asn Phe Ala Tyr Gly Thr Gln Arg Asp Tyr Leu Asp His Pro
Asp Val Ile Gly Trp Thr Arg Glu Gly Asp Gly Val His Ala Asn Ser Gly Leu Ala Thr Leu Leu Ser
Asp Gly Pro Gly Gly Ser Lys Trp Met Asp Val Gly Lys Asn Asn Ala Gly Glu Val Trp Tyr Asp Ile
Thr Gly Asn Gln Thr Asn Thr Val Thr Ile Asn Lys Asp Gly Trp Gly Gln Phe Tyr Val Ser Gly Gly
Ser Val Ser Ile Tyr Val Gln Arg

SEQ ID NO: 153

tgccttcaattaatgcaagcgattgcaaaaaaaggagataggagtatgaagaggaaaaatggactgcgtagcactatctttaccactagtt
atgagccttatcaacaacatacaagcagaacattacataataaagggtcgaacaggaaataaagacggaaatttttatgaact
gtatgtaattctttttatgatactgatagcaatggacatgggtgatttaaaaggcgtcacaagaaacttgattttaaatgatggaatccaagaac
aaataatgatcttcaataaacggatctggtgatgccttataacacctctcctagttatcacaaatatgatgtaacagattactataatcgcact
cagtatggaagtttacaagatttccgtgaactaacaacagaagcgcataaacgcaactgaaaggtagtaatagatcttgttattaatcatacaagc
agtgcacatccttgggttgcgatgcattaaaaataaaaaacagtaagatcgcagattactatatttgggctgataaaaaatacagacttaaatgaaaa
aggcccatggggtaacaagatggcacaagcgtcgaacggagagtatttctacgcaacgttctgggaaggatgccgacttaactatga
caaccctaaagtaagagaagaatgattaaaatcgggaaatttggctcaacaaggagctgatggctttcgtctagatgcagccatgcacatctt
taaagggcaaacacctgaaggagcaaaagaaaaatattgaatgggtgaatgaattccgcgacgcgatgagagaaacgaatccaatacgtatct
agttggtgaaatatgggatcaaccagaagtagttgctccgtattatcaatcgttagattctacatttaacttcgacttagcatataaaatcgtaattcc
gttaaaaatggtactgatcaaggggtagccgcggcagctgttgcaacggatgagttatataaaacataaatccaaataaaattgatggaacgttt
ttaacgaatcatgacaaaatcgtgtaatgagtgagttaatgggtgatgtaaaacaaatcagcagcctctattctgttgacactccctggta
atccgttatttatttggcgaagaaatcgcatgacaggccaaaaaccagatgagttgattcgtgagcctttccgttggtatgaagtataaag
aaggtcaaacgagctgggagactccagtatataacattgatcataatgggttttcagttgaagcacagaataacaaaaagcttcttctaagcc
attatcgtaaaaatgattcgtgttcgtcgaacacgatgaactgtcaaggttaattagaacctatttctgtaaatccacaggttggtgcctataat
cgtacgtataaaaaataatcaattcaagtgataacataatttcagacaagccggttacattaactgtttcaacaaaggaaaactgatttttctagt
gaattaggagcaaaaaaggaaaaatcaacattagtaattccagcgaatcacagctgtagtaaaagtaa



Figure 16LLL

SEQ ID NO: 154

Met Pro Ser Ile Asn Ala Ser Asp Cys Lys Lys Lys Gly Asp Arg Ser Met Lys Arg Lys Lys Trp Thr
Ala Leu Ala Leu Ser Leu Pro Leu Val Met Ser Leu Ser Thr Asn Ile Gln Ala Glu Thr Leu His Asn
Asn Lys Gly Gln Lys Ala Gln Thr Gly Asn Lys Asp Gly Ile Phe Tyr Glu Leu Tyr Val Asn Ser Phe
Tyr Asp Thr Asp Ser Asn Gly His Gly Asp Leu Lys Gly Val Thr Lys Lys Leu Asp Tyr Leu Asn
Asp Gly Asn Pro Arg Thr Asn Asn Asp Leu Gln Ile Asn Gly Ile Trp Met Met Pro Ile Asn Thr Ser
Pro Ser Tyr His Lys Tyr Asp Val Thr Asp Tyr Tyr Asn Ile Asp Pro Gln Tyr Gly Ser Leu Gln Asp
Phe Arg Glu Leu Thr Thr Glu Ala His Lys Arg Asn Val Lys Val Val Ile Asp Leu Val Ile Asn His
Thr Ser Ser Glu His Pro Trp Phe Val Asp Ala Leu Lys Asn Lys Asn Ser Lys Tyr Arg Asp Tyr Tyr
Ile Trp Ala Asp Lys Asn Thr Asp Leu Asn Glu Lys Gly Pro Trp Gly Gln Gln Val Trp His Lys Ala
Ser Asn Gly Glu Tyr Phe Tyr Ala Thr Phe Trp Glu Gly Met Pro Asp Leu Asn Tyr Asp Asn Pro Lys
Val Arg Glu Glu Met Ile Lys Ile Gly Lys Phe Trp Leu Lys Gln Gly Ala Asp Gly Phe Arg Leu Asp
Ala Ala Met His Ile Phe Lys Gly Gln Thr Pro Glu Gly Ala Lys Lys Asn Ile Glu Trp Trp Asn Glu
Phe Arg Asp Ala Met Arg Glu Thr Asn Pro Asn Thr Tyr Leu Val Gly Glu Ile Trp Asp Gln Pro Glu
Val Val Ala Pro Tyr Tyr Gln Ser Leu Asp Ser Thr Phe Asn Phe Asp Leu Ala Tyr Lys Ile Val Asn
Ser Val Lys Asn Gly Thr Asp Gln Gly Val Ala Ala Ala Val Ala Thr Asp Glu Leu Tyr Lys Thr
Tyr Asn Pro Asn Lys Ile Asp Gly Thr Phe Leu Thr Asn His Asp Gln Asn Arg Val Met Ser Glu Leu
Asn Gly Asp Val Asn Lys Ala Lys Ser Ala Ala Ser Ile Leu Leu Thr Leu Pro Gly Asn Pro Phe Ile
Tyr Tyr Gly Glu Glu Ile Gly Met Thr Gly Gln Lys Pro Asp Glu Leu Ile Arg Glu Pro Phe Arg Trp
Tyr Glu Asp Asp Lys Glu Gly Gln Thr Ser Trp Glu Thr Pro Val Tyr Asn Ile Asp His Asn Gly Val
Ser Val Glu Ala Gln Asp Lys Gln Lys Ala Ser Leu Leu Ser His Tyr Arg Lys Met Ile Arg Val Arg
Gln Gln His Asp Glu Leu Val Lys Gly Asn Leu Glu Pro Ile Ser Val Asn Asn Ser Gln Val Val Ala
Tyr Asn Arg Thr Tyr Lys Asn Lys Ser Ile Gln Val Tyr His Asn Ile Ser Asp Lys Pro Val Thr Leu
Thr Val Ser Asn Lys Gly Lys Leu Ile Phe Ser Ser Glu Leu Gly Ala Lys Lys Glu Lys Ser Thr Leu
Val Ile Pro Ala Asn Thr Thr Val Leu Val Lys

SEQ ID NO: 155

gtgtcaagaatgtttgcaaaacgattcaaaacctcttactgccgttattcgtgattttattgctgtttcatttggttctggcaggaccaacggctg
cgaatgctgaaacggctaacaatcaaatgagcttacagcaccgctgatcaaaagcggaaccattcttcattgcttgaattggtcgttcaatcgt
taaacacaaatgaaggatattcatgatgcaggatatacagcagctcagcgtccgattaaccaagtaaggaaggggaaccaaggaataa
aaacatgtcgaactggtactggtctatcagccgacatcgtacaaattggcaaccgttacttaggtactgaacaagaattaaagaaatgtgtgc
agccgctgaagaatatggcataaagggttattgttgacgcggtcatcaatcataccaccagtactatgccgcgatttccaatgagattaagagtatt
ccaaactggacacatggaacacacaaataaaaactggtctgatcgatgggatgtcacgcagaatgcattgctcgggctgtatgactggaata
cacaataacacaaagtacagtcctatttgaacgggttctagaagagcattgaatgacggggcagacgggttttcgatttgatgccgccaacata
tagagctccggatgatggcagttacggcagtcattttggccgaatatcacaatacatctgcagagttccaatacggagaaatcctgcaggat
agtgtctcaagagatgcttcatatgcgaattatgaatgtgacagcgtctaactatgggcatccataaggtccgctttaagaatcgtaatctggg
cgtgtcgaatatctcccactatgcacagatgtgtctgctggacaagctagtgacatgggtagaatcgcatgatacgtatgccaatgatgatgaag
agtcgacatggatgagcgtatgatatccgtttaggctggcggtgatagcttctcgttcaggcagtagccctctttctttccagacctgaggg
aggcggaatgggtgtgagattccgggggaaagccaaataggcgatcgcgaggatgctttatttgaagatcaggctatcactgcggtcaatag
attcacaatgtgatggctggacagcctgaggaactctcgaacccaaatggaacaaccagatatttgaatcagcgcggtcactatggcggtg
tgctggcaaatgcaggttcatcctctgtttctatcaatcgccaacaaatgcctgatggcaggtatgataataaagctggggcaggttcatttca
agtaaatgacggttaaactgacaggcacgatcaatgccaggtctgtggtctgtgtttatcctgatgatattgcaaaagcgccatgtttccttgag
aattacaaaacaggtgtaacacattcttcaatgatcaactgacgattacactgcgtgcagatgcgaatacaacaaaagccgtttatcaaatcaata
atggaccagagacggcggttaaggatggagatcaattcacaatcggaaggagatccatttggcaaaacatacaccatcatgttaaaaggaac
gaacagtgatgggtgaacgaggaccgaggaatacagtttgttaaaagagatccagcttcggccaaaaccatcggtatcaaaatccgaatcatt
ggagccaggtaaatgcttatctataaacatgatgggggcccgggca

SEQ ID NO: 156

Figure 16MMM



Applicant(s): Walter Callen et al.
ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

Val Ser Arg Met Phe Ala Lys Arg Phe Lys Thr Ser Leu Leu Pro Leu Phe Ala Gly Phe Leu Leu Leu
Phe His Leu Val Leu Ala Gly Pro Thr Ala Ala Asn Ala Glu Thr Ala Asn Lys Ser Asn Glu Leu Thr
Ala Pro Ser Ile Lys Ser Gly Thr Ile Leu His Ala Trp Asn Trp Ser Phe Asn Thr Leu Lys His Asn
Met Lys Asp Ile His Asp Ala Gly Tyr Thr Ala Ile Gln Thr Ser Pro Ile Asn Gln Val Lys Glu Gly
Asn Gln Gly Asn Lys Asn Met Ser Asn Trp Tyr Trp Leu Tyr Gln Pro Thr Ser Tyr Gln Ile Gly Asn
Arg Tyr Leu Gly Thr Glu Gln Glu Phe Lys Glu Met Cys Ala Ala Ala Glu Glu Tyr Gly Ile Lys Val
Ile Val Asp Ala Val Ile Asn His Thr Thr Ser Asp Tyr Ala Ala Ile Ser Asn Glu Ile Lys Ser Ile Pro
Asn Trp Thr His Gly Asn Thr Gln Ile Lys Asn Trp Ser Asp Arg Trp Asp Val Thr Gln Asn Ala Leu
Leu Gly Leu Tyr Asp Trp Asn Thr Gln Asn Thr Gln Val Gln Ser Tyr Leu Lys Arg Phe Leu Glu
Arg Ala Leu Asn Asp Gly Ala Asp Gly Phe Arg Phe Asp Ala Ala Lys His Ile Glu Leu Pro Asp Asp
Gly Ser Tyr Gly Ser Gln Phe Trp Pro Asn Ile Thr Asn Thr Ser Ala Glu Phe Gln Tyr Gly Glu Ile
Leu Gln Asp Ser Ala Ser Arg Asp Ala Ser Tyr Ala Asn Tyr Met Asn Val Thr Ala Ser Asn Tyr Gly
His Ser Ile Arg Ser Ala Leu Lys Asn Arg Asn Leu Gly Val Ser Asn Ile Ser His Tyr Ala Ser Asp
Val Ser Ala Asp Lys Leu Val Thr Trp Val Glu Ser His Asp Thr Tyr Ala Asn Asp Asp Glu Glu Ser
Thr Trp Met Ser Asp Asp Asp Ile Arg Leu Gly Trp Ala Val Ile Ala Ser Arg Ser Gly Ser Thr Pro
Leu Phe Phe Ser Arg Pro Glu Gly Gly Gly Asn Gly Val Arg Phe Pro Gly Lys Ser Gln Ile Gly Asp
Arg Gly Ser Ala Leu Phe Glu Asp Gln Ala Ile Thr Ala Val Asn Arg Phe His Asn Val Met Ala Gly
Gln Pro Glu Glu Leu Ser Asn Pro Asn Gly Asn Asn Gln Ile Phe Met Asn Gln Arg Gly Ser His Gly
Val Val Leu Ala Asn Ala Gly Ser Ser Ser Val Ser Ile Asn Thr Pro Thr Lys Leu Pro Asp Gly Arg
Tyr Asp Asn Lys Ala Gly Ala Gly Ser Phe Gln Val Asn Asp Gly Lys Leu Thr Gly Thr Ile Asn Ala
Arg Ser Val Ala Val Leu Tyr Pro Asp Asp Ile Ala Lys Ala Pro His Val Phe Leu Glu Asn Tyr Lys
Thr Gly Val Thr His Ser Phe Asn Asp Gln Leu Thr Ile Thr Leu Arg Ala Asp Ala Asn Thr Thr Lys
Ala Val Tyr Gln Ile Asn Asn Gly Pro Glu Thr Ala Phe Lys Asp Gly Asp Gln Phe Thr Ile Gly Lys
Gly Asp Pro Phe Gly Lys Thr Tyr Thr Ile Met Leu Lys Gly Thr Asn Ser Asp Gly Val Thr Arg Thr
Glu Glu Tyr Ser Phe Val Lys Arg Asp Pro Ala Ser Ala Lys Thr Ile Gly Tyr Gln Asn Pro Asn His
Trp Ser Gln Val Asn Ala Tyr Ile Tyr Lys His Asp Gly Gly Arg Ala

SEQ ID NO: 157

atgcaaacgattgcaaaaaaggggatgaaacgatgaaagggaataatggacagcattagcttaacactgccgctggctgctagcttatca
acaggcggtcacgccgaaaccgtacataaaggtaaacgtccaacagcagataaaacgggtgtctttatgaggtgtatgtaaactcttttacgat
gcaataaagatggacatggtgatttaaaaggcttacacaaaagctggattattgaatgacggcaattctcataccaaaatgatcttcaagtaa
acggaatttgatgatgccgtaaaccttctctagctatcataaatatgatgtaacggactattataacattgatccgcagtagcgaatctgca
agatttcgcaagctgatgaaagaagcagataaacgagacgtaaaagggtattatggacctggtgtgaatcatacaagcagtgaaatccttggtt
tcaagctgcattaaaagataaaaacagcaagtagacagattactatatttggccgataaaaatactgatttaaatgaaaaggatcttgggggca
gcaagtagtgcataaagctccaacggagagattttttgtagctgtttgggaaggaaatgcctgacttaaatcagataatcccgaagtaagaaa
agaaatgattaacgctgggaaattttggctaaagcaaggcgtgacgggtccgcttagatgctgcgcttcataattttaaagggtcaaacacgtgaa
ggcgctaagaaaaatcgtgtggtggaatgagtttagagatgcaatgaaaaagaaaaccctaacgtatatctaaccgggtgaagtaggggac
aacgggaagtagtagcttactatcaatcgttgattcttatttaactttgatttagcaggaaagattgtaaactctgtaaaatcaggaaatgatca
aggaatcgcgactgcagcagccgcaactgatgagctgttcaatcatacaatccaaataaaattgacggcattttcttaaccaacctgacaaa
atcgctcatgagtgagctaagcggcgatgtgaataaagcaaaagtcagctgcctctatcttacttacgcttcctggcaaccctgtatatttacgg
tgaagaaattggaatgaccggtgaaaagcctgatgagttatccgtgaaccgtccgctggtacgaaggcaatggacttgacaaccagctg
gaaacatccgtatacaaaaaggcggcaatggtgtgtagtagacacaaacaaaaggattcttggtaaatcattaccgtgaaatga
ttcgctgcgtcagcagcatgaagagtagtaaaaggaaaccttcaatctatttcagtagacagtaagaagtcgttgccctatagccgcacgtata
aaggcaaatcgattagcgtgtatcataatattcaaatcaaccggtaaaagtagtctgtaacagcgaaaggtaaattgatttttgtagtgaagggt
gcaaaaaagtcaaaatcagctgtgtgtccagctaatacaacgggtttaataaaaataa

SEQ ID NO: 158

Met Gln Thr Ile Ala Lys Lys Gly Asp Glu Thr Met Lys Gly Lys Lys Trp Thr Ala Leu Ala Leu Thr
Leu Pro Leu Ala Ala Ser Leu Ser Thr Gly Val His Ala Glu Thr Val His Lys Gly Lys Ala Pro Thr
Ala Asp Lys Asn Gly Val Phe Tyr Glu Val Tyr Val Asn Ser Phe Tyr Asp Ala Asn Lys Asp Gly His

Figure 16NNN



Applicant(s): Walter Callen et al.
ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

Gly Asp Leu Lys Gly Leu Thr Gln Lys Leu Asp Tyr Leu Asn Asp Gly Asn Ser His Thr Lys Asn
Asp Leu Gln Val Asn Gly Ile Trp Met Met Pro Val Asn Pro Ser Pro Ser Tyr His Lys Tyr Asp Val
Thr Asp Tyr Tyr Asn Ile Asp Pro Gln Tyr Gly Asn Leu Gln Asp Phe Arg Lys Leu Met Lys Glu Ala
Asp Lys Arg Asp Val Lys Val Ile Met Asp Leu Val Val Asn His Thr Ser Ser Glu His Pro Trp Phe
Gln Ala Ala Leu Lys Asp Lys Asn Ser Lys Tyr Arg Asp Tyr Tyr Ile Trp Ala Asp Lys Asn Thr Asp
Leu Asn Glu Lys Gly Ser Trp Gly Gln Gln Val Trp His Lys Ala Pro Asn Gly Glu Tyr Phe Tyr Gly
Thr Phe Trp Glu Gly Met Pro Asp Leu Asn Tyr Asp Asn Pro Glu Val Arg Lys Glu Met Ile Asn Val
Gly Lys Phe Trp Leu Lys Gln Gly Val Asp Gly Phe Arg Leu Asp Ala Ala Leu His Ile Phe Lys Gly
Gln Thr Pro Glu Gly Ala Lys Lys Asn Ile Val Trp Trp Asn Glu Phe Arg Asp Ala Met Lys Lys Glu
Asn Pro Asn Val Tyr Leu Thr Gly Glu Val Trp Asp Gln Pro Glu Val Val Ala Pro Tyr Tyr Gln Ser
Leu Asp Ser Leu Phe Asn Phe Asp Leu Ala Gly Lys Ile Val Asn Ser Val Lys Ser Gly Asn Asp Gln
Gly Ile Ala Thr Ala Ala Ala Ala Thr Asp Glu Leu Phe Lys Ser Tyr Asn Pro Asn Lys Ile Asp Gly
Ile Phe Leu Thr Asn His Asp Gln Asn Arg Val Met Ser Glu Leu Ser Gly Asp Val Asn Lys Ala Lys
Ser Ala Ala Ser Ile Leu Leu Thr Leu Pro Gly Asn Pro Tyr Ile Tyr Tyr Gly Glu Glu Ile Gly Met Thr
Gly Glu Lys Pro Asp Glu Leu Ile Arg Glu Pro Phe Arg Trp Tyr Glu Gly Asn Gly Leu Gly Gln Thr
Ser Trp Glu Thr Ser Val Tyr Asn Lys Gly Gly Asn Gly Val Ser Val Glu Thr Gln Thr Lys Gln Lys
Asp Ser Leu Leu Asn His Tyr Arg Glu Met Ile Arg Val Arg Gln Gln His Glu Glu Leu Val Lys Gly
Thr Leu Gln Ser Ile Ser Val Asp Ser Lys Glu Val Val Ala Tyr Ser Arg Thr Tyr Lys Gly Lys Ser Ile
Ser Val Tyr His Asn Ile Ser Asn Gln Pro Val Lys Val Ser Val Thr Ala Lys Gly Lys Leu Ile Phe Ala
Ser Glu Lys Gly Ala Lys Lys Val Lys Asn Gln Leu Val Val Pro Ala Asn Thr Thr Val Leu Ile Lys

SEQ ID NO: 159

ttgcaaaaaaaggggatgaaacgatgaaagggaaaaaatggacagcttttagctctaacactgccgctggctgctagcttatcaacaggcgttc
acgccgaaccgtacataaaggtaaatctccaacagcagataaaaacgggtgattttatgaggtgatgtaaacctcttttacgatgcaataaaga
tggacatgggtgatttaaaagggtctacacaaaagggtgatttttaaatgatggcaattctcatacaagaatgatcttcaagtaaacgggatttggat
gatgccgggtcaacccttctccagctatcataaataatgatgtaacggactattataatattgatccgcagatggaaatctgcaagatttctgcaaac
tgatgaaagaagcagataaacgagatgtaaaagtcattatggacctggttgtaatcatagcagcagtgaaacacccttgggttcaagctgcattaa
aagataaaaacagcaagtagagattactatctgggctgataaaaataccgacttgaatgaaaaaggatcttggggacagcaagtatggca
taaagctccaaacggagagtattttacggaacgitttgggaagggaatgccggactaaattacgataatcctgaagtaagaaaagaatgattaa
cgtaggaaaagtttggctaaagcaaggagttagtggttccgtctagatgctgcgcttcatatttttaaggccaacacctgaaggcgctaagaa
aaatctctctgtggtggaatgaatttagagatgcaatgaaaaaggaaaaccctaacgtatctaacgggtgaagtatgggtaacaccggaagta
gtagctcttactatcaatcgcttgattcttttaactttgatttagcaggaaagattgtaaacctgttaaatcaggaaatgatcaaggaatcgga
ctgcagcagcggcaacggatgaactgttcaaatcatacaatccaaataaaattgacgggtattttcttaaccaaccatgacaaaaatcgcgctatga
gtgagctaaacggcgatgtgaataaaagcaagtcagctgcctctatcttacttacgcttcttgcaacccgtatattattacggtagaagaaatcg
catgaccgggtgaaaagcctgatgagttaatccgtgaaccgttccccgtgtacgaaggaaacggacttggacaaccagctgggaaacacctgt
atatacaaaaggcggcaacggcgtgtctgtagaagcacaaacaaaaggactcttggtaaatcattaccgtgaaatgattcgctgcgtc
agcagcacgaagagtagtaaaaggaacgcttcaatctatttcagtagacagtaaaagaagtcgttgcctatagccgtacgtataaaggcaaatcg
attagcgtgtatcataatatttcaaatcaaccggtaaaagatctgtagcagcaaaaggtaaatgattttgctagtgaaaaagggtgctaagaaagt
caaaaatcagctgtgattccggcgaatacaacgggttttaataaaataa

SEQ ID NO: 160

Met Gln Lys Lys Gly Asp Glu Thr Met Lys Gly Lys Lys Trp Thr Ala Leu Ala Leu Thr Leu Pro
Leu Ala Ala Ser Leu Ser Thr Gly Val His Ala Glu Thr Val His Lys Gly Lys Ser Pro Thr Ala Asp
Lys Asn Gly Val Phe Tyr Glu Val Tyr Val Asn Ser Phe Tyr Asp Ala Asn Lys Asp Gly His Gly Asp
Leu Lys Gly Leu Thr Gln Lys Leu Asp Tyr Leu Asn Asp Gly Asn Ser His Thr Lys Asn Asp Leu
Gln Val Asn Gly Ile Trp Met Met Pro Val Asn Pro Ser Pro Ser Tyr His Lys Tyr Asp Val Thr Asp
Tyr Tyr Asn Ile Asp Pro Gln Tyr Gly Asn Leu Gln Asp Phe Arg Lys Leu Met Lys Glu Ala Asp
Lys Arg Asp Val Lys Val Ile Met Asp Leu Val Val Asn His Thr Ser Ser Glu His Pro Trp Phe Gln
Ala Ala Leu Lys Asp Lys Asn Ser Lys Tyr Arg Asp Tyr Tyr Ile Trp Ala Asp Lys Asn Thr Asp Leu
Asn Glu Lys Gly Ser Trp Gly Gln Gln Val Trp His Lys Ala Pro Asn Gly Glu Tyr Phe Tyr Gly Thr

Figure 16000



Phe Trp Glu Gly Met Pro Asp Leu Asn Tyr Asp Asn Pro Glu Val Arg Lys Glu Met Ile Asn Val Gly
Lys Phe Trp Leu Lys Gln Gly Val Asp Gly Phe Arg Leu Asp Ala Ala Leu His Ile Phe Lys Gly Gln
Thr Pro Glu Gly Ala Lys Lys Asn Leu Leu Trp Trp Asn Glu Phe Arg Asp Ala Met Lys Lys Glu
Asn Pro Asn Val Tyr Leu Thr Gly Glu Val Trp Asp Gln Pro Glu Val Val Ala Pro Tyr Tyr Gln Ser
Leu Asp Ser Leu Phe Asn Phe Asp Leu Ala Gly Lys Ile Val Asn Ser Val Lys Ser Gly Asn Asp Gln
Gly Ile Ala Thr Ala Ala Ala Thr Asp Glu Leu Phe Lys Ser Tyr Asn Pro Asn Lys Ile Asp Gly
Ile Phe Leu Thr Asn His Asp Gln Asn Arg Val Met Ser Glu Leu Asn Gly Asp Val Asn Lys Ala Lys
Ser Ala Ala Ser Ile Leu Leu Thr Leu Pro Gly Asn Pro Tyr Ile Tyr Tyr Gly Glu Glu Ile Gly Met Thr
Gly Glu Lys Pro Asp Glu Leu Ile Arg Glu Pro Phe Pro Trp Tyr Glu Gly Asn Gly Leu Gly Gln Thr
Ser Trp Glu Thr Pro Val Tyr Asn Lys Gly Gly Asn Gly Val Ser Val Glu Ala Gln Thr Lys Gln Lys
Asp Ser Leu Leu Asn His Tyr Arg Glu Met Ile Arg Val Arg Gln Gln His Glu Glu Leu Val Lys Gly
Thr Leu Gln Ser Ile Ser Val Asp Ser Lys Glu Val Val Ala Tyr Ser Arg Thr Tyr Lys Gly Lys Ser Ile
Ser Val Tyr His Asn Ile Ser Asn Gln Pro Val Lys Val Ser Val Ala Ala Lys Gly Lys Leu Ile Phe Ala
Ser Glu Lys Gly Ala Lys Lys Val Lys Asn Gln Leu Val Ile Pro Ala Asn Thr Thr Val Leu Ile Lys

SEQ ID NO: 161

gtggatccaaagaattgtagtcatttatgcaaacgattgcaaaaaaggggatgaacgatgaaagggaaaaaatggacagcttagctctaa
cactgccgctggtgctagcttatcaacaggtgttcacgccgaaaccgtacataaaggtaaagctccaacagcagataaaaacgggtgtctttat
gaggtatatgaaactcttttacgatgcaataaagatggacatggtgatttaaaaggccttacacaaaagtggactatttaaatgacggaaattc
tcatacaaagaatgatcttcaagtaaacgggatttggatgatgccggtcaacccttccttagctatcataaatatgatgaacggactattataat
tgatccgcagtatggaatctgcaagatttgcgaacttatgaaagaagcagataaacgagacgtaaaagtcattatggacctgtgtgtaacat
acgagcagtgaaaccccttggttcaagctgcgttgaaagataaaaacagcaagtacagagattactatatttgggctgataaaaatactgacttg
aatgaaaaaggatcttggggacaacaagtatggcataaagctccaacaggagatgttttacggaacgttctgggaagggaatgcctgacttaa
attacgataaccctgaagtaagaaaaaagaatgattaacgtcggaagtttggctaaacaaggcgttgacggctccgcttagatgctgcccttc
atattttaaaaggtcaaacgcctgaaggcgctaagaaaaacattctatggtggaatgagtttagatgcgatgaaaaaagaaaacccgaacgta
tatctaacgggtgaagtgtgggaccagccagaagtagtagcccttactatcaatcacttgattctctatttaattttagattagcaggaaaaattgtc
agctctgtaaaagcaggaaatgatcaaggaatcgccactgcagcagcggaactgatgagctgttcaaatcataaatccaaataaaattgacg
gcattttcttaaccaacctgacaaaatcgcgctatgagtgaagcggcgatgtaataaagcaaaatcagccgctctacttacttacgct
tcttggaatccgtatatatttacggtgaagaaattggcatgacaggtgaaaagcctgatgaattaatccgtgaaccgtccgctggtcgaagg
caacggaattggacaaactagctgggaaacacctgtatatacaaaggcggtaacggcgtgtctgtagaagcacaacaaaaacaaaggatt
cctgttaaatcattaccgtgaaatgattcgtgtgcgccagcagcacgaagagttagtaaaaggaacgcttcaatccatttcagtagacagtaaaag
aagtcgttgccatagccgcacgtacaaaggcaaatcgattagcgtgtatcataatatttcaaatcaacctgtaaaagtatctgtagcagcgaaag
gtaacttgattttgctagtgtgaaaagggtgtaagaaagtcaaaaatcagctgtgattccggcgaatgcgacgggtttaataaaaaataa

SEQ ID NO: 162

Val Asp Pro Lys Asn Cys Ser Gln Phe Met Gln Thr Ile Ala Lys Lys Gly Asp Glu Thr Met Lys Gly
Lys Lys Trp Thr Ala Leu Ala Leu Thr Leu Pro Leu Ala Ala Ser Leu Ser Thr Gly Val His Ala Glu
Thr Val His Lys Gly Lys Ala Pro Thr Ala Asp Lys Asn Gly Val Phe Tyr Glu Val Tyr Val Asn Ser
Phe Tyr Asp Ala Asn Lys Asp Gly His Gly Asp Leu Lys Gly Leu Thr Gln Lys Leu Asp Tyr Leu
Asn Asp Gly Asn Ser His Thr Lys Asn Asp Leu Gln Val Asn Gly Ile Trp Met Met Pro Val Asn Pro
Ser Pro Ser Tyr His Lys Tyr Asp Val Thr Asp Tyr Tyr Asn Ile Asp Pro Gln Tyr Gly Asn Leu Gln
Asp Phe Arg Lys Leu Met Lys Glu Ala Asp Lys Arg Asp Val Lys Val Ile Met Asp Leu Val Val
Asn His Thr Ser Ser Glu His Pro Trp Phe Gln Ala Ala Leu Lys Asp Lys Asn Ser Lys Tyr Arg Asp
Tyr Tyr Ile Trp Ala Asp Lys Asn Thr Asp Leu Asn Glu Lys Gly Ser Trp Gly Gln Gln Val Trp His
Lys Ala Pro Asn Gly Glu Tyr Phe Tyr Gly Thr Phe Trp Glu Gly Met Pro Asp Leu Asn Tyr Asp
Asn Pro Glu Val Arg Lys Glu Met Ile Asn Val Gly Lys Phe Trp Leu Lys Gln Gly Val Asp Gly Phe
Arg Leu Asp Ala Ala Leu His Ile Phe Lys Gly Gln Thr Pro Glu Gly Ala Lys Lys Asn Ile Leu Trp
Trp Asn Glu Phe Arg Asp Ala Met Lys Lys Glu Asn Pro Asn Val Tyr Leu Thr Gly Glu Val Trp
Asp Gln Pro Glu Val Val Ala Pro Tyr Tyr Gln Ser Leu Asp Ser Leu Phe Asn Phe Asp Leu Ala Gly
Lys Ile Val Ser Ser Val Lys Ala Gly Asn Asp Gln Gly Ile Ala Thr Ala Ala Ala Thr Asp Glu



Figure 16PPP

Leu Phe Lys Ser Tyr Asn Pro Asn Lys Ile Asp Gly Ile Phe Leu Thr Asn His Asp Gln Asn Arg Val
Met Ser Glu Leu Ser Gly Asp Val Asn Lys Ala Lys Ser Ala Ala Ser Ile Leu Leu Thr Leu Pro Gly
Asn Pro Tyr Ile Tyr Tyr Gly Glu Glu Ile Gly Met Thr Gly Glu Lys Pro Asp Glu Leu Ile Arg Glu
Pro Phe Arg Trp Tyr Glu Gly Asn Gly Ile Gly Gln Thr Ser Trp Glu Thr Pro Val Tyr Asn Lys Gly
Gly Asn Gly Val Ser Val Glu Ala Gln Thr Lys Gln Lys Asp Ser Leu Leu Asn His Tyr Arg Glu Met
Ile Arg Val Arg Gln Gln His Glu Glu Leu Val Lys Gly Thr Leu Gln Ser Ile Ser Val Asp Ser Lys
Glu Val Val Ala Tyr Ser Arg Thr Tyr Lys Gly Lys Ser Ile Ser Val Tyr His Asn Ile Ser Asn Gln Pro
Val Lys Val Ser Val Ala Ala Lys Gly Asn Leu Ile Phe Ala Ser Glu Lys Gly Ala Lys Lys Val Lys
Asn Gln Leu Val Ile Pro Ala Asn Ala Thr Val Leu Ile Lys

SEQ ID NO: 163

atggtacgtcccgaacgacgggctgcattggaaccgactatcgaacgactcgcagcacttgaagacattgggtgacgacggtgtgattccg
ccggcgtaaaaggcagctcacagaacgatgtcgggtatggggcgtagcatttatacgatctcggcgaattcaacaaaaaggacgacccg
gacgaagtacgggacgaaagcgcagctccagaccgccatctcgaacttgcgcggttaaagggtcgggtgtgtacggcgacgtcgtcatgaat
cacaaggcgggggccgattataccgaatccgttcaggcgatcgaggtaacccgtcgaaccggaaccaagaacgtccgggtgagtatggcat
ctcggcctggactgggttcaacttcgcggggcgaacaatacactcgccttcaaatggcgctgtgtaccattttgacgggtaccgattgggac
agtcacgcagcttgagccgcatctataagttcaagagcacaggcaaggcgtgggacacggacgtgtcgaacgagaacggcaactatgattat
cttatgtatgccgacgtcgatttcgagcatcccgaggtccgccaagagatgaagaactgggggcaaatgtacgccgactcgtcgggctcgac
ggtttcgggttgatgcgggtcaacatcagccactcgtactgaaggagtggtgacgagcgtgcgccagacgaccgggaaagagatgttc
acggtcgccgagtttggaagaacgatctcgggtccatcaacgactatctgtataagacgggctacacgcactccgtcttcgatgtgccgctcc
attataactccaaggcgccggttaacggcgccgggtattacgatatgcgcaacatcttgaaggcaccgtcaccgaacagcatccgtcgtgtc
cgtgacgattgtcgataaccagactcacagccgggcccagtcgctcagtcgacggtcgccaaactggttcaaacggctcgcctacgcgacga
tcattgacgcgcgggtcagggttatccggccctctcttatggagactattatggcacgaaagggacgacgaaccgcgaaatccgaacatgtcgg
gcacgctccaaccgattttgaaggcacgaaaagattcgctacgggacgcagcatgactacctcgatcatcaggacgtcgtcgggtgacac
gtgaagggtgtgaccgaccgtgccaatcggtctcgacgattctatcgacgggtccggcggtcgaagtggatgtacgtcggcaaacag
aacgccggcgaggtatggaagacatgacgaacaacacgccgctctgtcacgatcaatgctgacgggtggggtcagttcttcgtcaacgg
aggctcggctcgtattatcgaacaataa

SEQ ID NO: 164

Met Val Arg Pro Glu Arg Arg Ala Ala Leu Glu Pro Thr Ile Glu Arg Leu Ala Ala Leu Glu Arg His
Trp Val Thr Thr Val Trp Ile Pro Pro Ala Tyr Lys Gly Thr Ser Gln Asn Asp Val Gly Tyr Gly Ala
Tyr Asp Leu Tyr Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Thr Arg Thr Lys Tyr Gly Thr Lys
Ala Gln Leu Gln Thr Ala Ile Ser Asn Leu Arg Gly Lys Gly Ile Gly Val Tyr Gly Asp Val Val Met
Asn His Lys Gly Gly Ala Asp Tyr Thr Glu Ser Val Gln Ala Ile Glu Val Asn Pro Ser Asn Arg Asn
Gln Glu Thr Ser Gly Glu Tyr Gly Ile Ser Ala Trp Thr Gly Phe Asn Phe Ala Gly Arg Asn Asn Thr
Tyr Ser Pro Phe Lys Trp Arg Trp Tyr His Phe Asp Gly Thr Asp Trp Asp Gln Ser Arg Ser Leu Ser
Arg Ile Tyr Lys Phe Lys Ser Thr Gly Lys Ala Trp Asp Thr Asp Val Ser Asn Glu Asn Gly Asn Tyr
Asp Tyr Leu Met Tyr Ala Asp Val Asp Phe Glu His Pro Glu Val Arg Gln Glu Met Lys Asn Trp
Gly Lys Trp Tyr Ala Asp Ser Leu Gly Leu Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile Ser His
Ser Tyr Leu Lys Glu Trp Val Thr Ser Val Arg Gln Thr Thr Gly Lys Glu Met Phe Thr Val Ala Glu
Tyr Trp Lys Asn Asp Leu Gly Ala Ile Asn Asp Tyr Leu Tyr Lys Thr Gly Tyr Thr His Ser Val Phe
Asp Val Pro Leu His Tyr Asn Phe Gln Ala Ala Gly Asn Gly Gly Gly Tyr Tyr Asp Met Arg Asn Ile
Leu Lys Gly Thr Val Thr Glu Gln His Pro Ser Leu Ser Val Thr Ile Val Asp Asn His Asp Ser Gln
Pro Gly Gln Ser Leu Glu Ser Thr Val Ala Asn Trp Phe Lys Pro Leu Ala Tyr Ala Thr Ile Met Thr
Arg Gly Gln Gly Tyr Pro Ala Leu Phe Tyr Gly Asp Tyr Tyr Gly Thr Lys Gly Thr Thr Asn Arg Glu
Ile Pro Asn Met Ser Gly Thr Leu Gln Pro Ile Leu Lys Ala Arg Lys Asp Phe Ala Tyr Gly Thr Gln
His Asp Tyr Leu Asp His Gln Asp Val Ile Gly Trp Thr Arg Glu Gly Val Thr Asp Arg Ala Lys Ser
Gly Leu Ala Thr Ile Leu Ser Asp Gly Pro Gly Gly Ser Lys Trp Met Tyr Val Gly Lys Gln Asn Ala
Gly Glu Val Trp Lys Asp Met Thr Asn Asn Asn Ala Arg Leu Val Thr Ile Asn Ala Asp Gly Trp Gly
Gln Phe Phe Val Asn Gly Gly Ser Val Ser Ile Tyr Thr Gln Gln

Figure 16QQQ



SEQ ID NO: 165

atgcagtatattcagtggtacgtgccaaatgatggggaacattggaatcgtttgcgtaatgatgctgaaaattagctcataaaggaattacatctgt
atggataccaccggtatataaaggaacttcacaaaatgatgtagggtatggagtgtatgatgtatatgatttgggagaattcaatcaaaaaggaac
gatacggacaaaatattggacaaaagcacaaatctgcaattgaggctttacataatcaaaatcgcgtgtatccggtgatgtgttatgaac
cataaaggtggggcagattatactgaggttgtaacagccgttgaggttagaccgtaacaatcgaaatattgaaacatcgagtattcaaatagat
gcgtggacgggattgattttccaggacgcagggactcctattctaaatggagatgggttcattttgatggaacagattgggatgaggga
ggaaattaaatagaattataaatttaaaggcgtaggttaaagcttgggactgggaagtgtctagttagaagtgtaactatgattattaatgtatgca
gatcttgatttcgatcatcctgaagttgcaaatgaaatgaaaactggggaacctgggtatgcggacgaattaaatttagatggcttccgtttagacg
cagttaaacataattgacatgagtatctctgtgattgggtaaatcatgtagaaagcaaacggggaaggaaatgtttacagtagctgaattatggca
aaatgatattcgtactttaacaatttttagggaaagtaaattataatcaatctgtgttcgatgcaccttccattataattttcattatgcttcaacagg
gaatggaaattatgataggaatttttaaagggtacggttagtagaaagtcacacactgctgttactctgttgagaatcatgattctcagcc
tgacagtcattagaatctgtgtgagtcctgttgtaagccgttgacctatgcattattttaacgcgtgcagaagggtatcctctgtttttatggag
attactatggcacaaatggaaatagtagttatgaaatccaacgttaaaggataaaattgatccaattctgacggcacgaaaaactttgcatatgg
tacgcaacatgattatttagacatccagatgtgattggctggacaagagaaggggtagtatacatgctaattctggttagcaacattaatctctg
atggaccaggagatcaaaatggatgaatgttggaagaacaacgcaggggaaatattggtacgatattacgggcaatcaacaaatactgtaa
cgattaataaagatggatgggggcagttccatgtaaattggggctctgtttcaatatatgttcagaagtaa

SEQ ID NO: 166

Met Gln Tyr Phe Glu Trp Tyr Val Pro Asn Asp Gly Glu His Trp Asn Arg Leu Arg Asn Asp Ala
Glu Asn Leu Ala His Lys Gly Ile Thr Ser Val Trp Ile Pro Pro Val Tyr Lys Gly Thr Ser Gln Asn
Asp Val Gly Tyr Gly Val Tyr Asp Val Tyr Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Ile Arg Thr
Lys Tyr Gly Thr Lys Ala Gln Leu Lys Ser Ala Ile Glu Ala Leu His Asn Gln Asn Ile Asp Val Tyr
Gly Asp Val Val Met Asn His Lys Gly Gly Ala Asp Tyr Thr Glu Val Val Thr Ala Val Glu Val Asp
Arg Asn Asn Arg Asn Ile Glu Thr Ser Ser Asp Tyr Gln Ile Asp Ala Trp Thr Gly Phe Asp Phe Pro
Gly Arg Arg Asp Ser Tyr Ser Asn Phe Lys Trp Arg Trp Phe His Phe Asp Gly Thr Asp Trp Asp Glu
Gly Arg Lys Leu Asn Arg Ile Tyr Lys Phe Lys Gly Val Gly Lys Ala Trp Asp Trp Glu Val Ser Ser
Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Leu Asp Phe Asp His Pro Glu Val Ala Asn
Glu Met Lys Asn Trp Gly Thr Trp Tyr Ala Asp Glu Leu Asn Leu Asp Gly Phe Arg Leu Asp Ala
Val Lys His Ile Asp His Glu Tyr Leu Arg Asp Trp Val Asn His Val Arg Lys Gln Thr Gly Lys Glu
Met Phe Thr Val Ala Glu Tyr Trp Gln Asn Asp Ile Arg Thr Leu Asn Asn Tyr Leu Gly Lys Val Asn
Tyr Asn Gln Ser Val Phe Asp Ala Pro Leu His Tyr Asn Phe His Tyr Ala Ser Thr Gly Asn Gly Asn
Tyr Asp Met Arg Asn Ile Leu Lys Gly Thr Val Val Glu Ser His Pro Thr Leu Ala Val Thr Leu Val
Glu Asn His Asp Ser Gln Pro Gly Gln Ser Leu Glu Ser Val Val Ser Pro Trp Phe Lys Pro Leu Ala
Tyr Ala Phe Ile Leu Thr Arg Ala Glu Gly Tyr Pro Ser Val Phe Tyr Gly Asp Tyr Tyr Gly Thr Asn
Gly Asn Ser Ser Tyr Glu Ile Pro Thr Leu Lys Asp Lys Ile Asp Pro Ile Leu Thr Ala Arg Lys Asn
Phe Ala Tyr Gly Thr Gln His Asp Tyr Leu Asp His Pro Asp Val Ile Gly Trp Thr Arg Glu Gly Asp
Ser Ile His Ala Asn Ser Gly Leu Ala Thr Leu Ile Ser Asp Gly Pro Gly Gly Ser Lys Trp Met Asn
Val Gly Lys Asn Asn Ala Gly Glu Ile Trp Tyr Asp Ile Thr Gly Asn Gln Thr Asn Thr Val Thr Ile
Asn Lys Asp Gly Trp Gly Gln Phe His Val Asn Gly Gly Ser Val Ser Ile Tyr Val Gln Lys

SEQ ID NO: 167

atgcaaacgattgcaaaaaaggggatgaaacgatgaaagggaataatggacagctttagcttaacactgccgctggctgctagcttatca
acaggcgttcacgccgaaccgtacataaaggtaaatctccaacagcagataaaaacgggtgattttatgaggtgtatgaaactcttttacgatg
caataaagatggacatgggtgatttaaaggcttacacaaaagttggattatttaaattgatggcaattctcatacaagaatgatcttcaagtaaac
gggatttgatgacgggtcaacccttctccagctatcataaatgatgtaacggactattataattgatccgcagtatggaatctgcaag
attttcgcaactgatgaaagaagcagataaacgagatgtaaaagtcattatggacctcgttgtaatcatacgagcagtgaacaccttggttc
aagctgcattaaagataaaaaacgagacagagattactatctgggctgataaaaataccgacttgaatgaaaaaggatcttggggaca
gcaagtatggcataaagcccaaacggagagtatttttacggaacgttttgggaagggaatgccgacttaattacgataatcctgaagtaagaa
aagaaatgattaacgtaggaaagtttggctaaagcaaggagttgacgggttcgcttagatgctgcgctcatattttaaaggccaaacacctg



Figure 16RRR

aaggcgctaagaaaaatcctgtgtggaatgaatttagagatgcaatgaaaaaggaaaaccctaactatatacgggtgaagtatggga
 tcaaccggaagtagtagctccttactatcaatcgcttgattctttatctaactttgatttagcaggaaagattgtaaaactgtaaaatcaggaaatgat
 caaggaatcgcgactgcagcagcggaacggatgaactgttcaaatcatacaatccaaataaaattgacgggtattttcttaaccaacctatgacca
 aaatcgctcatgagtgagctaagcggcgatgtgaataaagcaaaagtcagctgacctatcttacttacgcttcttggaacccgtatattattac
 ggtgaagaaatcgcatgaccgggtgaaaagcctgatgagtaatccgtgaaccgttccgctgtgtacgaaggaaacggacttggacaaaccag
 ctgggaaacacctgtatacaacaaaggcggcaacggcggtgtctgtagaagcacaacaaacaaaaggactcttgttaaatcattaccgtgaa
 atgattcgcgtgcgcagcagcaggaagagtagtaaaaggaacgcttcaatctatttcagtagacagtaaaagaagtcgttgccatagccgcac
 gtataaaggcaatcgattagcgtgtatcataatatttcaaatcaaccggtaaaagtatctgtagcagcaaaaggtaaatgatttttgtagtgaaa
 aagggtgctaagaaagtcacaaatcagcttgtgattccggcgcaatacaacgggtttaataaaaaaa

SEQ ID NO: 168

Met Gln Thr Ile Ala Lys Lys Gly Asp Glu Thr Met Lys Gly Lys Lys Trp Thr Ala Leu Ala Leu Thr
 Leu Pro Leu Ala Ala Ser Leu Ser Thr Gly Val His Ala Glu Thr Val His Lys Gly Lys Ser Pro Thr
 Ala Asp Lys Asn Gly Val Phe Tyr Glu Val Tyr Val Asn Ser Phe Tyr Asp Ala Asn Lys Asp Gly His
 Gly Asp Leu Lys Gly Leu Thr Gln Lys Leu Asp Tyr Leu Asn Asp Gly Asn Ser His Thr Lys Asn
 Asp Leu Gln Val Asn Gly Ile Trp Met Met Pro Val Asn Pro Ser Pro Ser Tyr His Lys Tyr Asp Val
 Thr Asp Tyr Tyr Asn Ile Asp Pro Gln Tyr Gly Asn Leu Gln Asp Phe Arg Lys Leu Met Lys Glu Ala
 Asp Lys Arg Asp Val Lys Val Ile Met Asp Leu Val Val Asn His Thr Ser Ser Glu His Pro Trp Phe
 Gln Ala Ala Leu Lys Asp Lys Asn Ser Lys Tyr Arg Asp Tyr Tyr Ile Trp Ala Asp Lys Asn Thr Asp
 Leu Asn Glu Lys Gly Ser Trp Gly Gln Gln Val Trp His Lys Ala Pro Asn Gly Glu Tyr Phe Tyr Gly
 Thr Phe Trp Glu Gly Met Pro Asp Leu Asn Tyr Asp Asn Pro Glu Val Arg Lys Glu Met Ile Asn Val
 Gly Lys Phe Trp Leu Lys Gln Gly Val Asp Gly Phe Arg Leu Asp Ala Ala Leu His Ile Phe Lys Gly
 Gln Thr Pro Glu Gly Ala Lys Lys Asn Leu Leu Trp Trp Asn Glu Phe Arg Asp Ala Met Lys Lys
 Glu Asn Pro Asn Val Tyr Leu Thr Gly Glu Val Trp Asp Gln Pro Glu Val Val Ala Pro Tyr Tyr Gln
 Ser Leu Asp Ser Leu Phe Asn Phe Asp Leu Ala Gly Lys Ile Val Asn Ser Val Lys Ser Gly Asn Asp
 Gln Gly Ile Ala Thr Ala Ala Ala Thr Asp Glu Leu Phe Lys Ser Tyr Asn Pro Asn Lys Ile Asp
 Gly Ile Phe Leu Thr Asn His Asp Gln Asn Arg Val Met Ser Glu Leu Ser Gly Asp Val Asn Lys Ala
 Lys Ser Ala Ala Ser Ile Leu Leu Thr Leu Pro Gly Asn Pro Tyr Ile Tyr Tyr Gly Glu Glu Ile Gly Met
 Thr Gly Glu Lys Pro Asp Glu Leu Ile Arg Glu Pro Phe Arg Trp Tyr Glu Gly Asn Gly Leu Gly Gln
 Thr Ser Trp Glu Thr Pro Val Tyr Asn Lys Gly Gly Asn Gly Val Ser Val Glu Ala Gln Thr Lys Gln
 Lys Asp Ser Leu Leu Asn His Tyr Arg Glu Met Ile Arg Val Arg Gln Gln His Glu Glu Leu Val Lys
 Gly Thr Leu Gln Ser Ile Ser Val Asp Ser Lys Glu Val Val Ala Tyr Ser Arg Thr Tyr Lys Gly Lys
 Ser Ile Ser Val Tyr His Asn Ile Ser Asn Gln Pro Val Lys Val Ser Val Ala Ala Lys Gly Lys Leu Ile
 Phe Gly Ser Glu Lys Gly Ala Lys Lys Val Lys Asn Gln Leu Val Ile Pro Ala Asn Thr Thr Val Leu
 Ile Lys

SEQ ID NO: 169

atgaaaacattcaaatataaacgcactttttaccgctaaccctgtctgctcagtgctccttgctgggcaaaatggcaccatgatgcagtattt
 cattggtatgtacctaattgatggcgacattatggacgcaggtgaaagcaatgctccagcactcgtgaaaacggtttacagcgctctggctacc
 gccagcttacaaaggcgcggcgaggaatgacgtcggttatggcgctctatgatgtacgatttaggtgagttgatcaaaaggctcagtac
 gaacaaatcgccacaaaggctcagtcacatctctgcaatcaatgcccgcacacaacaatatccaaatctacggcgatgtgtgtttaaccac
 cgaggtggtgctgatgggaagtcgtgggtcgataccaagcgcttgattgggacacccgaacattgaactggcgacaaatggattgaagct
 tgggttgatgttaatttctggcgcaacaaatactcaaacctccattggacttggtatcactttgacggtgtgactgggatgatgccggcaa
 agaaaaagcgatctttaaattcaaaaggcgaaggaaaagcatgggattgggaagtcagctctgaaaaggcaattacgactacctaattgacgc
 cgatttagacatggatcaccaagaagtaacaagagctgaaagattgggtgagtggtacatcaacatgaccggcggttatggcttagaattg
 gatgccgtgaagcacattaaatcagtatctacaagagtggtatgatcattacgttggaacacaggcgaagagctttaccggttggtgagtt
 ggaattacgacgtaaatcaactgcataactttattactaagacctctggcagtatgtcgtgttcgatgcgccgttcacatgaactctacaacgcg
 tcaaaatctggcggaattacgatatgcgcaaatcatgaatggcaggtgatgaaggacaaccagtcgaagctgtgactctcgtagaaaacc
 acgatacacagccattgcaggcgtagagtcgacagtggttggttgtaagcctcttgcttacgcattcattttattgcgtgaagaaggttatcc
 atcagtggttacgcagattactacggcgcgagtagcagcacaaggtacacatcaatattggccaaagttccttacttgaaagaacttgtaa

Figure 16SSS



Applicant(s): Walter Callen et al.
ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

cactgcgtaaagagtatgcgtatggcaaacagaattcttatctcgaccactgggatgtgattggctggacccgagagggcgatgctgaacatcc
aaactcaatggcggatgatgatggaccaggtggcaaaaatggatgtataccggtaagccaagcacgcgctatgtcgacaagctgg
gtatccgaactgaagaagtttgaccgataccaatggctgggcagaatttctgtcaatgggttcagtcctcggttggtggcggttaagtaa

SEQ ID NO: 170

Met Lys Thr Phe Lys Leu Lys Arg Thr Phe Leu Pro Leu Thr Leu Leu Ser Ala Pro Ala Phe Ala
Gly Gln Asn Gly Thr Met Met Gln Tyr Phe His Trp Tyr Val Pro Asn Asp Gly Ala Leu Trp Thr Gln
Val Glu Ser Asn Ala Pro Ala Leu Ala Glu Asn Gly Phe Thr Ala Leu Trp Leu Pro Pro Ala Tyr Lys
Gly Ala Gly Gly Ser Asn Asp Val Gly Tyr Gly Val Tyr Asp Met Tyr Asp Leu Gly Glu Phe Asp
Gln Lys Gly Ser Val Arg Thr Lys Tyr Gly Thr Lys Ala Gln Tyr Ile Ser Ala Ile Asn Ala Ala His
Asn Asn Asn Ile Gln Ile Tyr Gly Asp Val Val Phe Asn His Arg Gly Gly Ala Asp Gly Lys Ser Trp
Val Asp Thr Lys Arg Val Asp Trp Asp Asn Arg Asn Ile Glu Leu Gly Asp Lys Trp Ile Glu Ala Trp
Val Glu Phe Asn Phe Pro Gly Arg Asn Asp Lys Tyr Ser Asn Phe His Trp Thr Trp Tyr His Phe Asp
Gly Val Asp Trp Asp Ala Gly Lys Glu Lys Ala Ile Phe Lys Phe Lys Gly Glu Gly Lys Ala Trp
Asp Trp Glu Val Ser Ser Glu Lys Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Leu Asp Met Asp
His Gln Glu Val Lys Gln Glu Leu Lys Asp Trp Gly Glu Trp Tyr Ile Asn Met Thr Gly Val Asp Gly
Phe Arg Met Asp Ala Val Lys His Ile Lys Tyr Gln Tyr Leu Gln Glu Trp Ile Asp His Leu Arg Trp
Lys Thr Gly Lys Glu Leu Phe Thr Val Gly Glu Tyr Trp Asn Tyr Asp Val Asn Gln Leu His Asn
Phe Ile Thr Lys Thr Ser Gly Ser Met Ser Leu Phe Asp Ala Pro Leu His Met Asn Phe Tyr Asn Ala
Ser Lys Ser Gly Gly Asn Tyr Asp Met Arg Gln Ile Met Asn Gly Thr Leu Met Lys Asp Asn Pro Val
Lys Ala Val Thr Leu Val Glu Asn His Asp Thr Gln Pro Leu Gln Ala Leu Glu Ser Thr Val Asp Trp
Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu Leu Arg Glu Glu Gly Tyr Pro Ser Val Phe Tyr Ala
Asp Tyr Tyr Gly Ala Gln Tyr Ser Asp Lys Gly Tyr Asn Ile Asn Met Ala Lys Val Pro Tyr Ile Glu
Glu Leu Val Thr Leu Arg Lys Glu Tyr Ala Tyr Gly Lys Gln Asn Ser Tyr Leu Asp His Trp Asp Val
Ile Gly Trp Thr Arg Glu Gly Asp Ala Glu His Pro Asn Ser Met Ala Val Ile Met Ser Asp Gly Pro
Gly Gly Lys Lys Trp Met Tyr Thr Gly Lys Pro Ser Thr Arg Tyr Val Asp Lys Leu Gly Ile Arg Thr
Glu Glu Val Trp Thr Asp Thr Asn Gly Trp Ala Glu Phe Pro Val Asn Gly Gly Ser Val Ser Val Trp
Val Gly Val Lys

SEQ ID NO: 171

gtgtatgtaaactctttttacgatgcaataaagatggacatggtgatttaaaaggtcttacacaaaagtggattatttaaatgatggcaatttcata
caaagaatgatctcaagtaaacgggatttgatgatgccggtaacccttctccagctatcataaataatgatgtaacggactattataatattgat
ccgcaglatggaatctgcaagattttcgcaaaactgatgaaagaacagataaacgagatgtaaaagtcattatggacctgttgtaatcatatc
gagcagtgaacaccttggtttcaagctgcattaaaagataaaaacagcaagtagacagattactatctgggctgataaaaataaccgactga
atgaaaaaggatcttggggacagcaagtagtgcaataagccccaaacggagagtagttttacggaaaggtttgggaaggaaatgccggacttaaa
ttacgataatcctgaagtaagaaaagaaatgattaacgtaggaagttttggctaaagcaaggagttgacgggtccgcttagatgctgcgcttca
tatttttaaaaggccaacacctgaaggcgtaagaaaatctcctgtggtggaatgaatttagagatgcaatgaaaaaggaaaacctaacgtat
atctaacgggtgaagtagtggaatcaaccggaagtagtagctcttactatcaatcgcttgattctttatttaactttgatttagcaggaaaagattgtaa
actctgtaaaatcaggaaatgatcaaggaatcgcgactgcagcagcggaacggatgaactgttcaaatcatataatcaataaaattgacgg
tattttcttaaccaacctgaccaaatacgcgatgagtgagtaagcggcgatgtgaataaagcaagtcagctgcctctatcttacttacgctt
cctggcaacccgtatatttattacggtgaagaaatcgcatgaccgggtgaaaagcctgatgagttatccgtgaaccgttccgctggtacgaagg
aaacggacttgacaaaccagctgggaaacacctgtatacaaaaaggcggcaacggcgtgtctgtagaagcacaacaaaacaaaaggac
tctttgttaaatcattaccgtgaaatgattcgctgcgtcagcagcaggaagagttagtaaaaggaaacgcttcaatctatttcagtagacagtaaag
aagtcgttgctatagccgcacgtataaaggcaaatcgattagcgtgtatcataatatttcaaatcaaccggtaaaagtagtctagcagcaaaag
gtaaattgattttgtagtgaagaaaggtgtaagaaagtcaaaatcagcttgattccggcgaatacaacgggtttaataaaaataa

SEQ ID NO: 172

Val Tyr Val Asn Ser Phe Tyr Asp Ala Asn Lys Asp Gly His Gly Asp Leu Lys Gly Leu Thr Gln
Lys Leu Asp Tyr Leu Asn Asp Gly Asn Ser His Thr Lys Asn Asp Leu Gln Val Asn Gly Ile Trp
Met Met Pro Val Asn Pro Ser Pro Ser Tyr His Lys Tyr Asp Val Thr Asp Tyr Tyr Asn Ile Asp Pro

Figure 16TTT



Gln Tyr Gly Asn Leu Gln Asp Phe Arg Lys Leu Met Lys Glu Ala Asp Lys Arg Asp Val Lys Val
 Ile Met Asp Leu Val Val Asn His Thr Ser Ser Glu His Pro Trp Phe Gln Ala Ala Leu Lys Asp Lys
 Asn Ser Lys Tyr Arg Asp Tyr Tyr Ile Trp Ala Asp Lys Asn Thr Asp Leu Asn Glu Lys Gly Ser Trp
 Gly Gln Gln Val Trp His Lys Ala Pro Asn Gly Glu Tyr Phe Tyr Gly Thr Phe Trp Glu Gly Met Pro
 Asp Leu Asn Tyr Asp Asn Pro Glu Val Arg Lys Glu Met Ile Asn Val Gly Lys Phe Trp Leu Lys
 Gln Gly Val Asp Gly Phe Arg Leu Asp Ala Ala Leu His Ile Phe Lys Gly Gln Thr Pro Glu Gly Ala
 Lys Lys Asn Leu Leu Trp Trp Asn Glu Phe Arg Asp Ala Met Lys Lys Glu Asn Pro Asn Val Tyr
 Leu Thr Gly Glu Val Trp Asp Gln Pro Glu Val Val Ala Pro Tyr Tyr Gln Ser Leu Asp Ser Leu Phe
 Asn Phe Asp Leu Ala Gly Lys Ile Val Asn Ser Val Lys Ser Gly Asn Asp Gln Gly Ile Ala Thr Ala
 Ala Ala Ala Thr Asp Glu Leu Phe Lys Ser Tyr Asn Pro Asn Lys Ile Asp Gly Ile Phe Leu Thr Asn
 His Asp Gln Asn Arg Val Met Ser Glu Leu Ser Gly Asp Val Asn Lys Ala Lys Ser Ala Ala Ser Ile
 Leu Leu Thr Leu Pro Gly Asn Pro Tyr Ile Tyr Tyr Gly Glu Glu Ile Gly Met Thr Gly Glu Lys Pro
 Asp Glu Leu Ile Arg Glu Pro Phe Arg Trp Tyr Glu Gly Asn Gly Leu Gly Gln Thr Ser Trp Glu Thr
 Pro Val Tyr Asn Lys Gly Gly Asn Gly Val Ser Val Glu Ala Gln Thr Lys Gln Lys Asp Ser Leu Leu
 Asn His Tyr Arg Glu Met Ile Arg Val Arg Gln Gln His Glu Glu Leu Val Lys Gly Thr Leu Gln Ser
 Ile Ser Val Asp Ser Lys Glu Val Val Ala Tyr Ser Arg Thr Tyr Lys Gly Lys Ser Ile Ser Val Tyr His
 Asn Ile Ser Asn Gln Pro Val Lys Val Ser Val Ala Ala Lys Gly Lys Leu Ile Phe Gly Ser Glu Lys
 Gly Ala Lys Lys Val Lys Asn Gln Leu Val Ile Pro Ala Asn Thr Thr Val Leu Ile Lys

SEQ ID NO: 173

atgcaaacgattgcaaaaaaaggggatgaaacgatgaaagggaataatggacagcttagctctaactgccgctggctgctagcttatca
 acaggcgttcacgcagaaactgtacataaaggtaaaagctccaacagcagataaaaacgggtgttttatgaggtgtatgaaactcttttacgatg
 caaataaagatggacatggtgattaaaaggctgacacaaaagttggattattaaatgacggcaattctcatacaagaatgatcttcaagtaaa
 cgggatttggatgatgccggtaaaccccttctctagctatcataaatatgatgtaacggactattataacattgatcctcagtagcgaagtctgcaa
 gattccgcaaacgatgaaagaagcagataaacgagacgtaaaagtattatggacctgtgtgtaacatcacgagcagtgaaacaccccttggtt
 caagctgcactaaaagataaaaacagcaagtagacagattactatatttggcgtgataaaaataccgatttgtaaaaggatcttggggaca
 gcaagtatggcataaagctccaacggagagtagttttacggaacgttctgggaagggaatgcctgacttaattacgataaacctgaagtaagaa
 aagaaatgattaacgtcggaaggttttggctaaagcaaggcgttgatggctccgcttagatgctgcccttcatactttaaaggctaaactcctga
 aggcgctaagaaaaatcctctgtgtggaatgagtttagagatgcaatgaaaaagaaaaaccctaactatataacgggtgaagtagggat
 cagccggaagtagtagctccttattatcaatcgcttgattccctatttaactttgatttagcaggaaaaattgtcagctctgtaaaagcaggaaatgat
 caaggaatgccactgcagcagcggaacggatgagctgttcaatcatacaatccaaataaaattgacggcattttctaaccaaacatgacca
 aaaccgcgtcatgagtgagctaagcggagatgtgaataaagcaaaatcagctgcttctatcttacttacgcttctggaaatccgtatatttattacg
 gtgaagaanaattggcatgaccgggtgaaaagcctgatgaattaatccgtgaacgggtccgctggtacgaaggcaacggaattggacaaactagct
 gggaaacacctgtatatacaaaaggcggaatgggtgtgtctgtagaagcacaacaaacaaaaggattcttgttaaatcattaccgtgaaatg
 attcgcgtgcgcagcagcaagaagtagtaaaaggaacgcttcagctatttcagtagacagtaaaagaagttgtcgttatagccgtacgtat
 aaaggcaactccattagtgtgtatcataatatttcaaatcaacctgtaaaagtatctgtagcggcgaaaggtaaatgattttgctagtgtgaaaagg
 tgctaaaaaaggcaaaatcagcttgattccggcggaatgcgacgggtttaataaaataa

SEQ ID NO: 174

Met Gln Thr Ile Ala Lys Lys Gly Asp Glu Thr Met Lys Gly Lys Lys Trp Thr Ala Leu Ala Leu Thr
 Leu Pro Leu Ala Ala Ser Leu Ser Thr Gly Val His Ala Glu Thr Val His Lys Gly Lys Ala Pro Thr
 Ala Asp Lys Asn Gly Val Phe Tyr Glu Val Tyr Val Asn Ser Phe Tyr Asp Ala Asn Lys Asp Gly His
 Gly Asp Leu Lys Gly Leu Thr Gln Lys Leu Asp Tyr Leu Asn Asp Gly Asn Ser His Thr Lys Asn
 Asp Leu Gln Val Asn Gly Ile Trp Met Met Pro Val Asn Pro Ser Tyr His Lys Tyr Asp Val
 Thr Asp Tyr Tyr Asn Ile Asp Pro Gln Tyr Gly Ser Leu Gln Asp Phe Arg Lys Leu Met Lys Glu Ala
 Asp Lys Arg Asp Val Lys Val Ile Met Asp Leu Val Val Asn His Thr Ser Ser Glu His Pro Trp Phe
 Gln Ala Ala Leu Lys Asp Lys Asn Ser Lys Tyr Arg Asp Tyr Tyr Ile Trp Ala Asp Lys Asn Thr Asp
 Leu Asn Glu Lys Gly Ser Trp Gly Gln Gln Val Trp His Lys Ala Pro Asn Gly Glu Tyr Phe Tyr Gly
 Thr Phe Trp Glu Gly Met Pro Asp Leu Asn Tyr Asp Asn Pro Glu Val Arg Lys Glu Met Ile Asn Val
 Gly Lys Phe Trp Leu Lys Gln Gly Val Asp Gly Phe Arg Leu Asp Ala Ala Leu His Ile Phe Lys Gly



Figure 16UUU

Gln Thr Pro Glu Gly Ala Lys Lys Asn Leu Leu Trp Trp Asn Glu Phe Arg Asp Ala Met Lys Lys
Glu Asn Pro Asn Val Tyr Leu Thr Gly Glu Val Trp Asp Gln Pro Glu Val Val Ala Pro Tyr Tyr Gln
Ser Leu Asp Ser Leu Phe Asn Phe Asp Leu Ala Gly Lys Ile Val Ser Ser Val Lys Ala Gly Asn Asp
Gln Gly Ile Ala Thr Ala Ala Ala Thr Asp Glu Leu Phe Lys Ser Tyr Asn Pro Asn Lys Ile Asp
Gly Ile Phe Leu Thr Asn His Asp Gln Asn Arg Val Met Ser Glu Leu Ser Gly Asp Val Asn Lys Ala
Lys Ser Ala Ala Ser Ile Leu Leu Thr Leu Pro Gly Asn Pro Tyr Ile Tyr Tyr Gly Glu Glu Ile Gly Met
Thr Gly Glu Lys Pro Asp Glu Leu Ile Arg Glu Pro Phe Arg Trp Tyr Glu Gly Asn Gly Ile Gly Gln
Thr Ser Trp Glu Thr Pro Val Tyr Asn Lys Gly Gly Asn Gly Val Ser Val Glu Ala Gln Thr Lys Gln
Lys Asp Ser Leu Leu Asn His Tyr Arg Glu Met Ile Arg Val Arg Gln Gln His Glu Glu Leu Val Lys
Gly Thr Leu Gln Ser Ile Ser Val Asp Ser Lys Glu Val Val Ala Tyr Ser Arg Thr Tyr Lys Gly Asn
Ser Ile Ser Val Tyr His Asn Ile Ser Asn Gln Pro Val Lys Val Ser Val Ala Ala Lys Gly Lys Leu Ile
Phe Ala Ser Glu Lys Gly Ala Lys Lys Gly Lys Asn Gln Leu Val Ile Pro Ala Asn Ala Thr Val Leu
Ile Lys

SEQ ID NO: 175

atgaaaaatataatcacgactttgtgctgccagcgctatcctcacgggtgtcccacgccagttacgccgacgcaattttacacgcgtttaactggcaat
ataccgatgaaccgcaatgcaaatcaaatgccgcaaatggctttaaaaaagtcctcatccaccgcaatgaaatccagcggcagtcgaatgg
tgggcccgtatcaaccgcaagacttgcgtgtcattgattctccgtgggcaacaagaatttagtcgcgatgatcaatgcgctcaacagcgt
tggggtcgacgtgtatgctgacgtggtgcttaaccatattgctaacgagtcagtggaagcgcagtgacctaactccggggagtgaggtgct
caacgactatcaatcccgcagtgcttactatcaaaggcaaacacttttggcaatttacaggagaacctttttccgagaatgattccatccggca
ggcgtgtattaccaattggaatgatcctggccacgtccagttatggcgcttggcgggcgacagggcgatactgggctaccggatcctgatcctaa
tcaatgggtgtgagtcagcagaagagttacttgaacgcactcaaatcaatgggaatcaaagggttccgatcgcggtcaaacatagagtc
aatatcaaatagaccaagtgtttacccagacattaccgctggtatgcataattcggagaagtcattaccagtggtgggcaagggtgatagcggt
atgaggcttttctggcccttacctaataatcaccgatcacgccgcttatgacttcccgcattttgcatcgattcgagccgcgttttcattctctggtgg
gttaaatcagctacacaatccacaagcctatggccaagcgttacaggactcacgtgcgatcacctttacgattaccacagacattccaaccaatg
acgggttccgctaccagatcatggatccaaccgatgaacagctcgcctatgcctacatcttgggcaaatgaggaacgccactgtctatagt
gatgacctacctgacagcgaagacaaagacagtggtcgttggggccgatgtgtggcaagatccgaacatgattaacatgcttgcctccacaacg
cgatgaaggacaaagcatgactgtagtggctagcgatcaatgtaccttgcatttaagcgcggcaagcaaggcgtggttaggaatcaataatg
tggcgagagtaagtcggtgactgtcgatactaccagcatgagtttaactggtacaccccgtaaccaagacgtattgagcggcgacatcaccaca
tgtagttctcgttatcacaattgttttgccagcgcgcagtgcaaggatgtggaaactataa

SEQ ID NO: 176

Met Lys Asn Ile Ile Arg Leu Cys Ala Ala Ser Ala Ile Leu Thr Val Ser His Ala Ser Tyr Ala Asp Ala
Ile Leu His Ala Phe Asn Trp Gln Tyr Thr Asp Val Thr Ala Asn Ala Asn Gln Ile Ala Ala Asn Gly
Phe Lys Lys Val Leu Ile Ser Pro Ala Met Lys Ser Ser Gly Ser Gln Trp Trp Ala Arg Tyr Gln Pro
Gln Asp Leu Arg Val Ile Asp Ser Pro Leu Gly Asn Lys Gln Asp Leu Val Ala Met Ile Asn Ala Leu
Asn Ser Val Gly Val Asp Val Tyr Ala Asp Val Val Leu Asn His Met Ala Asn Glu Ser Trp Lys Arg
Ser Asp Leu Asn Tyr Pro Gly Ser Glu Val Leu Asn Asp Tyr Gln Ser Arg Ser Ala Tyr Tyr Gln Arg
Gln Thr Leu Phe Gly Asn Leu Gln Glu Asn Leu Phe Ser Glu Asn Asp Phe His Pro Ala Gly Cys Ile
Thr Asn Trp Asn Asp Pro Gly His Val Gln Tyr Trp Arg Leu Cys Gly Gly Gln Gly Asp Thr Gly
Leu Pro Asp Leu Asp Pro Asn Gln Trp Val Val Ser Gln Gln Lys Ser Tyr Leu Asn Ala Leu Lys Ser
Met Gly Ile Lys Gly Phe Arg Ile Asp Ala Val Lys His Met Ser Gln Tyr Gln Ile Asp Gln Val Phe
Thr Pro Asp Ile Thr Ala Gly Met His Ile Phe Gly Glu Val Ile Thr Ser Gly Gly Gln Gly Asp Ser Gly
Tyr Glu Ala Phe Leu Ala Pro Tyr Leu Asn Asn Thr Asp His Ala Ala Tyr Asp Phe Pro Leu Phe Ala
Ser Ile Arg Ala Ala Phe Ser Phe Ser Gly Gly Leu Asn Gln Leu His Asn Pro Gln Ala Tyr Gly Gln
Ala Leu Gln Asp Ser Arg Ala Ile Thr Phe Thr Ile Thr His Asp Ile Pro Thr Asn Asp Gly Phe Arg
Tyr Gln Ile Met Asp Pro Thr Asp Glu Leu Ala Tyr Ala Tyr Ile Leu Gly Lys Asp Gly Gly Thr
Pro Leu Val Tyr Ser Asp Leu Pro Asn Ser Glu Asp Lys Asp Ser Gly Arg Trp Ala Asp Val Trp
Gln Asp Pro Asn Met Ile Asn Met Leu Ala Phe His Asn Ala Met Gln Gly Gln Ser Met Thr Val Val
Ala Ser Asp Gln Cys Thr Leu Leu Phe Lys Arg Gly Lys Gln Gly Val Val Gly Ile Asn Lys Cys Gly

Figure 16VVV



Glu Ser Lys Ser Val Thr Val Asp Thr Tyr Gln His Glu Phe Asn Trp Tyr Thr Pro Tyr Gln Asp Val
Leu Ser Gly Asp Ile Thr Thr Val Ser Ser Arg Tyr His Gln Phe Val Leu Pro Ala Arg Ser Ala Arg
Met Trp Lys Leu

SEQ ID NO: 177

atgaaaacattcaaatfaaaacgcactttttaccgctgaccttgctgctcagtgctccttgctgggcaaaatggcaccatgatgcagtatttt
cattggtacgtacctaataatgatggcgacattatggacgcaggttgaaagcaatgctccagctactcgtgaaaacgggttttacagcgtctggtacc
gcccgcatacaaaaggcgccggcgccagtaataacgctgctgctatgatgtacgatttaggtgagtttgacaaaaaggctcagta
cgaaccaaatacggcaccgaaggctcagtaacatctctgcaatcaatgccgcgcacaacaacaatatccaaattacggcgacgttggtttaacca
ccgaggtggcgctgatgggaagtcgtgggtcgataccaagcgcgttgattgggacaaccgcaatattgaactggcgacaaatggattgaag
cttgggttgagtttaatttctggccgcaacgacaatactcgaacttccattggacttggtatcactttgacgggttgactgggatgatgccggc
aaagaaaaagcgatctttaaatcaaaaggcgaaggaaagcatgggattgggaagtcagctctgaaaaaggcaattacgactacctaattgtac
gccgatttagacatggatcacccagaagttaaacaagagctgaaagattgggggtgagtggtacatcaacatgaccggcggttgatggcttagaa
tggtatgccgtgaagcacattaaatatcagtatctacaagagtggttgatcatttacgttggaacaggcgaagagctttaccggttggtgagta
ttggaattacgacgtaatacaactgcacaactttattactaagacctctggcagtatgctggttgatgcgccgcttcacatgaattctacaacgc
gtcaaaatctggcgacattacgatatgcgccaatcatgaatggcacgttgatgaaggacaacccagtcgaagcagtgactctcgtagaaaac
cacgatacgcagccattgcagcggttagagtcgacagtagattgggtggttcaagcctcttgcttacgcattcattttatgcgtgaagaaggttatc
catcggtgttctacgcagattactacggcgccagtcacgcagacaaggttacaacattaatatggccaaagtgccttacattgaagaactgttaa
cactgcgtaaaagagtatcgctatggcaaacagaattcttatctcgaccattgggatgtgattggctggaccgagagggcgatgctgaacatcc
aaactcaatggcggtgatcatgagtgatggaccggcgccacaaaatggatgtataccggtgaagccaagtacgcgctatgctgacaagctgg
gtatccgaactgaagatgtttggaccgatgccaatggctgggcagaatttctgtcaatgggtggttcagtcctcggttgggtggcggttaagtaa

SEQ ID NO: 178

Met Lys Thr Phe Lys Leu Lys Arg Thr Phe Leu Pro Leu Thr Leu Leu Ser Ala Pro Ala Phe Ala
Gly Gln Asn Gly Thr Met Met Gln Tyr Phe His Trp Tyr Val Pro Asn Asp Gly Ala Leu Trp Thr Gln
Val Glu Ser Asn Ala Pro Val Leu Ala Glu Asn Gly Phe Thr Ala Leu Trp Leu Pro Pro Ala Tyr Lys
Gly Ala Gly Gly Ser Asn Asp Val Gly Tyr Gly Val Tyr Asp Met Tyr Asp Leu Gly Glu Phe Asp
Gln Lys Gly Ser Val Arg Thr Lys Tyr Gly Thr Lys Ala Gln Tyr Ile Ser Ala Ile Asn Ala Ala His
Asn Asn Asn Ile Gln Ile Tyr Gly Asp Val Val Phe Asn His Arg Gly Gly Ala Asp Gly Lys Ser Trp
Val Asp Thr Lys Arg Val Asp Trp Asp Asn Arg Asn Ile Glu Leu Gly Asp Lys Trp Ile Glu Ala Trp
Val Glu Phe Asn Phe Pro Gly Arg Asn Asp Lys Tyr Ser Asn Phe His Trp Thr Trp Tyr His Phe Asp
Gly Val Asp Trp Asp Ala Gly Lys Glu Lys Ala Ile Phe Lys Phe Lys Gly Glu Gly Lys Ala Trp
Asp Trp Glu Val Ser Ser Glu Lys Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Leu Asp Met Asp
His Pro Glu Val Lys Gln Glu Leu Lys Asp Trp Gly Glu Trp Tyr Ile Asn Met Thr Gly Val Asp Gly
Phe Arg Met Asp Ala Val Lys His Ile Lys Tyr Gln Tyr Leu Gln Glu Trp Ile Asp His Leu Arg Trp
Lys Thr Gly Lys Glu Leu Phe Thr Val Gly Glu Tyr Trp Asn Tyr Asp Val Asn Gln Leu His Asn
Phe Ile Thr Lys Thr Ser Gly Ser Met Ser Leu Phe Asp Ala Pro Leu His Met Asn Phe Tyr Asn Ala
Ser Lys Ser Gly Gly Thr Tyr Asp Met Arg Gln Ile Met Asn Gly Thr Leu Met Lys Asp Asn Pro Val
Lys Ala Val Thr Leu Val Glu Asn His Asp Thr Gln Pro Leu Gln Ala Leu Glu Ser Thr Val Asp Trp
Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu Leu Arg Glu Glu Gly Tyr Pro Ser Val Phe Tyr Ala
Asp Tyr Tyr Gly Ala Gln Tyr Ser Asp Lys Gly Tyr Asn Ile Asn Met Ala Lys Val Pro Tyr Ile Glu
Glu Leu Val Thr Leu Arg Lys Glu Tyr Ala Tyr Gly Lys Gln Asn Ser Tyr Leu Asp His Trp Asp Val
Ile Gly Trp Thr Arg Glu Gly Asp Ala Glu His Pro Asn Ser Met Ala Val Ile Met Ser Asp Gly Pro
Gly Gly Thr Lys Trp Met Tyr Thr Gly Lys Pro Ser Thr Arg Tyr Val Asp Lys Leu Gly Ile Arg Thr
Glu Asp Val Trp Thr Asp Ala Asn Gly Trp Ala Glu Phe Pro Val Asn Gly Gly Ser Val Ser Val Trp
Val Gly Val Lys

SEQ ID NO: 179

atgaaaacattcaaatfaaaacgcactttttaccgctaacttgctgctcagtgctccttgcccttgccgggcaaaatggcaccatgatgcagtactt
tcattggtacgtacctaataatgatggcgacattatggacgcaggttgaaagcaatgctccagcactcgtgaaaacgggttttacagcgtctggtacc

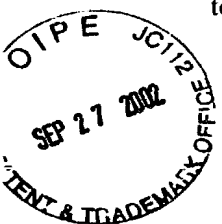


Figure 16WWW

gccagcttacaaggcgcgggcgggcagta.tgatgtcggttatggcgctctacgatatgtacgatttaggtgagttgatcaaaaaggctcagtac
gaaccaatacggtagcaaggctcagtagatctctgcaatcaatgctgcgcacaacaacaatatccaaatttaccggcgacgttggtttaaccatc
gtggtggcgctgatgggaagtcgtgggtcgataccaagcggttgattgggacaaccgtaacattgaactggcgacaaatggattgaagctt
gggttgagtttaattttctagccgcaacgacaaatactgaacttccattggacttggtatcactttgacgggtgtgactgggatgatccggcaa
agaaaaagcgatctttaaattcaaaaggcgaaggaaaaagcatgggattgggaagtcagctctgaaaaaggcaattacgactacctaattgtacgc
cgatttagacatggatcacccagaagttaaacaagagctgaaagattggggtgagtggtacatcaacatgaccggcggttgatggctttagaatg
gatgccgttaagcacattaaatatcagtatctacaagagtggttgatcatttaccgttgaaaacaggcaaaagagcttttaccgttggtgagattg
gaattacgacgtaaatcaactgcataactttattactaagacctctggcagtatgtcgttgctgatgcgccgcttccatgaactctacaacgcgt
caaatctggcggaattacgatatgcgcaaatcatgaatggcacgttgatgaaggacaacccagtcgaaagctgtgactctctagaaaacca
cgatacgagccattgcaggcggttagctgacagtggttggttgcaagcctcttgcctacgcattcatcttgtgcgtgaagaaggttatcca
tcggtgtctacgcagattactacggcgcgagtagcagcgacaaaggttacaacattaatatggccaaagtgccttaccattgaagaacttgtaaca
ctgcgtaaagagtatgcgtatggcaaacagaattcttatctcgaccattgggatgtgattggctggactcgagaggcgatgctgaacatccaaa
ctcaatggcggtgatcatgagtgatggaccggcggaacaaaatggatgtataccggtaatccaagcacgcgtatgtcgacaagctgggtat
ccgaactgaagatgttggaccgatgccaatggctgggcagaatttctgtcaatgggtggtcagtcctcggttgggtggcggttaagtaa

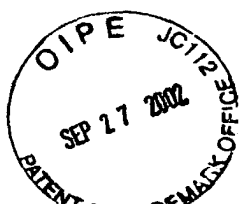
SEQ ID NO: 180

Met Lys Thr Phe Lys Leu Lys Arg Thr Phe Leu Pro Leu Thr Leu Leu Ser Ala Pro Ala Phe Ala
Gly Gln Asn Gly Thr Met Met Gln Tyr Phe His Trp Tyr Val Pro Asn Asp Gly Ala Leu Trp Thr Gln
Val Glu Ser Asn Ala Pro Ala Leu Ala Glu Asn Gly Phe Thr Ala Leu Trp Leu Pro Pro Ala Tyr Lys
Gly Ala Gly Gly Ser Asn Asp Val Gly Tyr Gly Val Tyr Asp Met Tyr Asp Leu Gly Glu Phe Asp
Gln Lys Gly Ser Val Arg Thr Lys Tyr Gly Thr Lys Ala Gln Tyr Ile Ser Ala Ile Asn Ala Ala His
Asn Asn Asn Ile Gln Ile Tyr Gly Asp Val Val Phe Asn His Arg Gly Gly Ala Asp Gly Lys Ser Trp
Val Asp Thr Lys Arg Val Asp Trp Asp Asn Arg Asn Ile Glu Leu Gly Asp Lys Trp Ile Glu Ala Trp
Val Glu Phe Asn Phe Pro Ser Arg Asn Asp Lys Tyr Ser Asn Phe His Trp Thr Trp Tyr His Phe Asp
Gly Val Asp Trp Asp Asp Ala Gly Lys Glu Lys Ala Ile Phe Lys Phe Lys Gly Glu Gly Lys Ala Trp
Asp Trp Glu Val Ser Ser Glu Lys Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Leu Asp Met Asp
His Pro Glu Val Lys Gln Glu Leu Lys Asp Trp Gly Glu Trp Tyr Ile Asn Met Thr Gly Val Asp Gly
Phe Arg Met Asp Ala Val Lys His Ile Lys Tyr Gln Tyr Leu Gln Glu Trp Ile Asp His Leu Arg Trp
Lys Thr Gly Lys Glu Leu Phe Thr Val Gly Glu Tyr Trp Asn Tyr Asp Val Asn Gln Leu His Asn
Phe Ile Thr Lys Thr Ser Gly Ser Met Ser Leu Phe Asp Ala Pro Leu His Met Asn Phe Tyr Asn Ala
Ser Lys Ser Gly Gly Asn Tyr Asp Met Arg Gln Ile Met Asn Gly Thr Leu Met Lys Asp Asn Pro Val
Lys Ala Val Thr Leu Val Glu Asn His Asp Thr Gln Pro Leu Gln Ala Leu Glu Ser Thr Val Asp Trp
Trp Phe Lys Pro Leu Ala Tyr Ala Phe Ile Leu Leu Arg Glu Glu Gly Tyr Pro Ser Val Phe Tyr Ala
Asp Tyr Tyr Gly Ala Gln Tyr Ser Asp Lys Gly Tyr Asn Ile Asn Met Ala Lys Val Pro Tyr Ile Glu
Glu Leu Val Thr Leu Arg Lys Glu Tyr Ala Tyr Gly Lys Gln Asn Ser Tyr Leu Asp His Trp Asp Val
Ile Gly Trp Thr Arg Glu Gly Asp Ala Glu His Pro Asn Ser Met Ala Val Ile Met Ser Asp Gly Pro
Gly Gly Thr Lys Trp Met Tyr Thr Gly Asn Pro Ser Thr Arg Tyr Val Asp Lys Leu Gly Ile Arg Thr
Glu Asp Val Trp Thr Asp Ala Asn Gly Trp Ala Glu Phe Pro Val Asn Gly Gly Ser Val Ser Val Trp
Val Gly Val Lys

SEQ ID NO: 181

ttgcagaggccttcggcctggccattacgccgtcacatagccggcgggggaggttggtggcggtgcgcgccccggcgagcctgccgatgc
cggtctccactggcgccggttcacctcgtccggcgcttcgtcgccgggtcatccgaacaagcacaagaaccggagtattcgatgaccaca
ccctcggtgcgccggttcggcggttcctgctgcggttccccgccctcgctgaccaggcggaagagcccgccggtgcgtgcattacca
cggcggcgacgaaatcatctccagggttcactggaaagctgtccgcgaagcgccaacgactggtacacatcttcgccagcaggcct
cgacgatcgccgcggacggcttctcggaatctggatgccgttgccctggcggtgacttctcagctggaccgacggcggaagtcaggcgg
cggcgaaggctacttctggcacgacttcaacaagaacggcgctacggcgacgcagccagctgcgccaggccggcgccgactcggtgg
cgccgggtgaagggtgctctacgatgtgtgcccacacatgaaccggcggtatccggacaaggagatcaacctgccggcgccggcggg
ttctggcgcaacgactgcaccgacccggcaactacccaacgactgcgatgacgggtgaccgttcatcgccggcaagtcggacctgaaca
ccggccatccgcagatctacggcatgttctcgacgagcttgccaacctgcgcagcgggtacggcgccggcggttccgcttcgacttcgttc

Figure 16XXX



Applicant(s): Walter Callen et al.
ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

gcggctatgcgcccgaacgggtcgacagctggatgagcgacagcgccgacagcagtttctgcgttggcgagctgtggaaaagcccgtccga
gtacccgagctgggactggcgcaacacggcgagctggcagcagatcatcaaggactggctccgaccgggccaagtccccgtgttcgacttc
gcgctcaaggagcgcatgcagaacggctcggtcgccgactggaagcatggcctcaatggcaacccggaccgcgctggcgcgaggtggc
ggtgacctttgtcgacaaccacgacaccggctattcgccggggcagaacggcgccagcaccactgggcgctgcaggacgggctgatccg
ccaggcctacgctacatcctcaccagcccgggcacgcccgggtggtgtactggtcgacatgtacgactggggctacggcgacttcattcgcca
gctgatccaggtgcgccgacccgctggcggtgcgcgcccattcgccgatcagcttccacagcggtacagcgccctggtcgctaccgtcagc
ggcagccatcagaccctggtggtggcgctcaactccgatctggccaacccggccaggtcgccagcgccagcttcagcgagggcggtcaac
gccagcaacggccaggtgcgcgctctggcgagcggtagcgggcgatggcgggcggaatgacggcgccgagggcggtctggtcaatgtgaa
cttcgctgcgacaacggcggtgacgcagatggcgacagcgctacgcggtgggcaacgctcagccagctcggaactggagcccggcctc
cgcggtacggctgacgcacaccagcagctatccgacctggaagggcagcatcgccctgcctgacggtcagaacgtggaatggaagtgcctg
atccgtaacgagggcgacgcgacgctggtgcgccagtggcaatcggcgccgaacaaccaggtccaggccgctgccggcgagcacca
cgggctcgttctga

SEQ ID NO: 182

Met Pro Glu Ala Phe Gly Leu Ala Ile Thr Pro Ser His Ser Arg Arg Gly Arg Leu Val Gly Val Ser
Arg Gly Gly Ser Leu Pro Met Pro Val Leu His Trp Pro Ala Phe Ile Leu Val Arg Arg Phe Val Ala
Gly His Pro Asn Lys His Lys Asn Arg Ser Ile Ala Met Ser His Thr Leu Arg Ala Ala Val Leu Ala
Ala Ile Leu Leu Pro Phe Pro Ala Leu Ala Asp Gln Ala Gly Lys Ser Pro Ala Gly Val Arg Tyr His
Gly Gly Asp Glu Ile Ile Leu Gln Gly Phe His Trp Asn Val Val Arg Glu Ala Pro Asn Asp Trp Tyr
Asn Ile Leu Arg Gln Gln Ala Ser Thr Ile Ala Ala Asp Gly Phe Ser Ala Ile Trp Met Pro Val Pro Trp
Arg Asp Phe Ser Ser Trp Thr Asp Gly Gly Lys Ser Gly Gly Gly Glu Gly Tyr Phe Trp His Asp Phe
Asn Lys Asn Gly Arg Tyr Gly Ser Asp Ala Gln Leu Arg Gln Ala Ala Gly Ala Leu Gly Gly Ala
Gly Val Lys Val Leu Tyr Asp Val Val Pro Asn His Met Asn Arg Gly Tyr Pro Asp Lys Glu Ile Asn
Leu Pro Ala Gly Gln Gly Phe Trp Arg Asn Asp Cys Thr Asp Pro Gly Asn Tyr Pro Asn Asp Cys
Asp Asp Gly Asp Arg Phe Ile Gly Gly Lys Ser Asp Leu Asn Thr Gly His Pro Gln Ile Tyr Gly Met
Phe Arg Asp Glu Leu Ala Asn Leu Arg Ser Gly Tyr Gly Ala Gly Gly Phe Arg Phe Asp Phe Val
Arg Gly Tyr Ala Pro Glu Arg Val Asp Ser Trp Met Ser Asp Ser Ala Asp Ser Ser Phe Cys Val Gly
Glu Leu Trp Lys Ser Pro Ser Glu Tyr Pro Ser Trp Asp Trp Arg Asn Thr Ala Ser Trp Gln Gln Ile Ile
Lys Asp Trp Ser Asp Arg Ala Lys Cys Pro Val Phe Asp Phe Ala Leu Lys Glu Arg Met Gln Asn
Gly Ser Val Ala Asp Trp Lys His Gly Leu Asn Gly Asn Pro Asp Pro Arg Trp Arg Glu Val Ala Val
Thr Phe Val Asp Asn His Asp Thr Gly Tyr Ser Pro Gly Gln Asn Gly Gly Gln His His Trp Ala Leu
Gln Asp Gly Leu Ile Arg Gln Ala Tyr Ala Tyr Ile Leu Thr Ser Pro Gly Thr Pro Val Val Tyr Trp Ser
His Met Tyr Asp Trp Gly Tyr Gly Asp Phe Ile Arg Gln Leu Ile Gln Val Arg Arg Thr Ala Gly Val
Arg Ala Asp Ser Ala Ile Ser Phe His Ser Gly Tyr Ser Gly Leu Val Ala Thr Val Ser Gly Ser His Gln
Thr Leu Val Val Ala Leu Asn Ser Asp Leu Ala Asn Pro Gly Gln Val Ala Ser Gly Ser Phe Ser Glu
Ala Val Asn Ala Ser Asn Gly Gln Val Arg Val Trp Arg Ser Gly Ser Gly Asp Gly Gly Gly Asn Asp
Gly Gly Glu Gly Gly Leu Val Asn Val Asn Phe Arg Cys Asp Asn Gly Val Thr Gln Met Gly Asp
Ser Val Tyr Ala Val Gly Asn Val Ser Gln Leu Gly Asn Trp Ser Pro Ala Ser Ala Val Arg Leu Thr
Asp Thr Ser Ser Tyr Pro Thr Trp Lys Gly Ser Ile Ala Leu Pro Asp Gly Gln Asn Val Glu Trp Lys
Cys Leu Ile Arg Asn Glu Ala Asp Ala Thr Leu Val Arg Gln Trp Gln Ser Gly Gly Asn Asn Gln Val
Gln Ala Ala Ala Gly Ala Ser Thr Ser Gly Ser Phe

SEQ ID NO: 183

atgcaaacgattgcaaaaaaggggatgaacgatgaaagggaataatggacagcttagcttaacactgccgctggctgctagcttatca
acaggcgttcacgccgaaccgtacataaaggtaagctgaagcaacagataaaaacgggtgtctttatgagggtgatgaaactcttttacgata
caataaagatggacatggtgatttaaaggctcgacacaaaagttggattatataatgacggcaattctcatataaagaatgatcttcaagtaa
cgggatttgatgacagtcacaccttctcctagctatcataaataatgatgtaacggactattataacattgatcctcagtagcgaatctgcaag
atttcgcaagctgatgaaagaagcagacaaacgagacgtaaaagtcattatggacctgtgtgtaatacatagcagcagcgaacaccccttggtt
caagctgcattaaagaataaagcaagtagcagattactatatttggcgctgataaaaaatccgattgaaatgaaaaggatcttgggggca
gcaagtatggcataaagctccaaacggagagtagttttacggaacgttttgggaaggaaatgcctgacttaattacgataaacctgaagtaagaa

Figure 16YYY



aagaaatgattaacgctggaaagtttggctaaagcaaggcgtaatggcttcgctagatgctgcgcttcataattttaagggtcaaacacctga
aggcgctaagaaaaatctctgtggtggaatgagtttagagatgcgatgaaaaagaaaaccctaacgtatatctaacgggtgaagtatgggat
cagcctgaagtgtagctccttactatcaatcgcttgattctttatattttgatttagcaggaaaaattgacgctctgtaaaagcaggaaatgatc
aaggaaatcgccactgcagcagcggcaacagatgaactgttcaaatcatacaatccaaataaaattgacggcattttcttaaccaacctgacca
aatcgctcatgagtgagctgagcggcgatgtgaacaaagcaaaatcagctgcttctacttactacgcttctggaacccgtatatttattacg
gtgaagaaattggcatgaccgggtgaaaagcctgatgagtaatccgtgaaccattccgctggtacgaaggaacggacttggacaaactagct
gggaacacctgtatataacaaaggcggcaacggcgtgtctgtagaagtacaaacaaacaaaaggattcttggtaaatcattatcgtgaaatg
attcgcgtgcgcagcagcatgaagagtagtaaaaggaacgcttcaatctatttcagtagacagtaaaagagtggttgccatagtcgcacgtat
aaaggcaactcgattagcgtgtatcataatatttcaaatcaacctgtaaaagtatctgtagcagcgaaaggtaaattgattttgctagtgtgaaaagg
tgctaaaaaagtcaaaaatcagcttgaattccggctaatacaacgggtttaataaaaataa

SEQ ID NO: 184

Met Gln Thr Ile Ala Lys Lys Gly Asp Glu Thr Met Lys Gly Lys Lys Trp Thr Ala Leu Ala Leu Thr
Leu Pro Leu Ala Ala Ser Leu Ser Thr Gly Val His Ala Glu Thr Val His Lys Gly Lys Ser Glu Ala
Thr Asp Lys Asn Gly Val Phe Tyr Glu Val Tyr Val Asn Ser Phe Tyr Asp Thr Asn Lys Asp Gly His
Gly Asp Leu Lys Gly Leu Thr Gln Lys Leu Asp Tyr Leu Asn Asp Gly Asn Ser His Thr Lys Asn
Asp Leu Gln Val Asn Gly Ile Trp Met Met Pro Val Asn Pro Ser Pro Ser Tyr His Lys Tyr Asp Val
Thr Asp Tyr Tyr Asn Ile Asp Pro Gln Tyr Gly Asn Leu Gln Asp Phe Arg Lys Leu Met Lys Glu Ala
Asp Lys Arg Asp Val Lys Val Ile Met Asp Leu Val Val Asn His Thr Ser Ser Glu His Pro Trp Phe
Gln Ala Ala Leu Lys Asp Lys Asn Ser Lys Tyr Arg Asp Tyr Tyr Ile Trp Ala Asp Lys Asn Thr Asp
Leu Asn Glu Lys Gly Ser Trp Gly Gln Gln Val Trp His Lys Ala Pro Asn Gly Glu Tyr Phe Tyr Gly
Thr Phe Trp Glu Gly Met Pro Asp Leu Asn Tyr Asp Asn Pro Glu Val Arg Lys Glu Met Ile Asn Val
Gly Lys Phe Trp Leu Lys Gln Gly Val Asn Gly Phe Arg Leu Asp Ala Ala Leu His Ile Phe Lys Gly
Gln Thr Pro Glu Gly Ala Lys Lys Asn Ile Leu Trp Trp Asn Glu Phe Arg Asp Ala Met Lys Lys Glu
Asn Pro Asn Val Tyr Leu Thr Gly Glu Val Trp Asp Gln Pro Glu Val Val Ala Pro Tyr Tyr Gln Ser
Leu Asp Ser Leu Phe Asn Phe Asp Leu Ala Gly Lys Ile Val Ser Ser Val Lys Ala Gly Asn Asp Gln
Gly Ile Ala Thr Ala Ala Ala Thr Asp Glu Leu Phe Lys Ser Tyr Asn Pro Asn Lys Ile Asp Gly
Ile Phe Leu Thr Asn His Asp Gln Asn Arg Val Met Ser Glu Leu Ser Gly Asp Val Asn Lys Ala Lys
Ser Ala Ala Ser Ile Leu Leu Thr Leu Pro Gly Asn Pro Tyr Ile Tyr Tyr Gly Glu Glu Ile Gly Met Thr
Gly Glu Lys Pro Asp Glu Leu Ile Arg Glu Pro Phe Arg Trp Tyr Glu Gly Asn Gly Leu Gly Gln Thr
Ser Trp Glu Thr Pro Val Tyr Asn Lys Gly Gly Asn Gly Val Ser Val Glu Val Gln Thr Lys Gln Lys
Asp Ser Leu Leu Asn His Tyr Arg Glu Met Ile Arg Val Arg Gln Gln His Glu Glu Leu Val Lys Gly
Thr Leu Gln Ser Ile Ser Val Asp Ser Lys Glu Val Val Ala Tyr Ser Arg Thr Tyr Lys Gly Asn Ser Ile
Ser Val Tyr His Asn Ile Ser Asn Gln Pro Val Lys Val Ser Val Ala Ala Lys Gly Lys Leu Ile Phe Ala
Ser Glu Lys Gly Ala Lys Lys Val Lys Asn Gln Leu Val Ile Pro Ala Asn Thr Thr Val Leu Ile Lys

SEQ ID NO: 185

atgaaactgatgaaagggaaaaatggacagctttagctctaactgcccgtggtgctagcttatcaacaggcggttcacgccgaactgtac
ataaaggtaaagctccaacagcagataaaaacgggtgtctttatgaggtgtatgaaactcttttacgatgcaaataaagatggacatggtgattta
aaaggctctacacaaaagctggactatttaaatgacggaaattctacatacaagaatgatcttcaagtaaacgggatttgatgatgccagtcac
ccttctcctagctatcataaataatgatgaacggattattataacattgatccgcagtagcggaaatctgcaagatttgcgaagctgatgaaagaagc
agacaaacgagacgtaaaagtcattatggaccttgtgtgaatcatcagcagcgaacacccttggtttcaagctgcgttaaaagataaaaaca
gcaagtacagagattactatatttgggctgataaaaataccgacttgaatgaaaaggatcttggggacagcaagtaggcataaagctccaac
ggagagtattttacggaacgttttgggaaggaaatgcctgacttaattacgataaccctgaagtaagaaaagaatgattaacgctggaaagttt
ggctaaagcaaggcgttgatggctccgcttagatgctgcgcttcatatttttaagggtcaaacgcctgaaggcgctaaagaaatattctgtggt
ggaatgagtttagagatgcgatgaaaaagaaaaccctaactgtatatctaacgggtgaagtagtggaatcagcctgaagtggtagctccttactat
caatcgcttgattccctatttaactttgatttagcagggaaaattgtcagttctgtaaaagcaggaaatgatcaaggaatcgccactgcagcagcgg
caacggatgagctgttcaaatcatacaatccaaataaaattgacggcattttcttaaccaacctgaccaaaccgcgctatgagtgaactgatcg
cgatgtgaacaaagcaaaatcagctgcttctacttactacgcttctggaacccgtatatttattacgggtgaagaaattggcatgaccgggtga
aaagcctgatgagtaatccgtgaaccgtccgctggtacgaaggaacggacttggacaaccagctgggaacacacctgtatatacaaaagg

Figure 16ZZZ



cgccaacggcgtgtctgtagaagcacaaacaaacaaaaggattcttgttaaatcattaccgtgaaa:gattcgcgtgcgtcagcagcatgaag
agttagtaaaaggaacgttcaatctatttttagtagacagtaaaagaagttgttcctatagccgtacgtataaagacaactcgattagcgtgtatcat
aatatttcaaatcaaccggtaaaagtatctgtagcagcaaaaggtaaatatttttgcctagtgtgaaaaagggtctaaaaaagtcaagaatcagcttg
tgattccggctaatacaacgggttttaataaaataa

SEQ ID NO: 186

Met Lys Leu Met Lys Gly Lys Lys Trp Thr Ala Leu Ala Leu Thr Leu Pro Leu Ala Ala Ser Leu Ser
Thr Gly Val His Ala Glu Thr Val His Lys Gly Lys Ala Pro Thr Ala Asp Lys Asn Gly Val Phe Tyr
Glu Val Tyr Val Asn Ser Phe Tyr Asp Ala Asn Lys Asp Gly His Gly Asp Leu Lys Gly Leu Thr
Gln Lys Leu Asp Tyr Leu Asn Asp Gly Asn Ser His Thr Lys Asn Asp Leu Gln Val Asn Gly Ile Trp
Met Met Pro Val Asn Pro Ser Pro Ser Tyr His Lys Tyr Asp Val Thr Asp Tyr Tyr Asn Ile Asp Pro
Gln Tyr Gly Asn Leu Gln Asp Phe Arg Lys Leu Met Lys Glu Ala Asp Lys Arg Asp Val Lys Val
Ile Met Asp Leu Val Val Asn His Thr Ser Ser Glu His Pro Trp Phe Gln Ala Ala Leu Lys Asp Lys
Asn Ser Lys Tyr Arg Asp Tyr Tyr Ile Trp Ala Asp Lys Asn Thr Asp Leu Asn Glu Lys Gly Ser Trp
Gly Gln Gln Val Trp His Lys Ala Pro Asn Gly Glu Tyr Phe Tyr Gly Thr Phe Trp Glu Gly Met Pro
Asp Leu Asn Tyr Asp Asn Pro Glu Val Arg Lys Glu Met Ile Asn Val Gly Lys Phe Trp Leu Lys
Gln Gly Val Asp Gly Phe Arg Leu Asp Ala Ala Leu His Ile Phe Lys Gly Gln Thr Pro Glu Gly Ala
Lys Lys Asn Ile Leu Trp Trp Asn Glu Phe Arg Asp Ala Met Lys Lys Glu Asn Pro Asn Val Tyr Leu
Thr Gly Glu Val Trp Asp Gln Pro Glu Val Val Ala Pro Tyr Tyr Gln Ser Leu Asp Ser Leu Phe Asn
Phe Asp Leu Ala Gly Lys Ile Val Ser Ser Val Lys Ala Gly Asn Asp Gln Gly Ile Ala Thr Ala Ala
Ala Ala Thr Asp Glu Leu Phe Lys Ser Tyr Asn Pro Asn Lys Ile Asp Gly Ile Phe Leu Thr Asn His
Asp Gln Asn Arg Val Met Ser Glu Leu Ile Gly Asp Val Asn Lys Ala Lys Ser Ala Ala Ser Ile Leu
Leu Thr Leu Pro Gly Asn Pro Tyr Ile Tyr Tyr Gly Glu Glu Ile Gly Met Thr Gly Glu Lys Pro Asp
Glu Leu Ile Arg Glu Pro Phe Arg Trp Tyr Glu Gly Asn Gly Leu Gly Gln Thr Ser Trp Glu Thr Pro
Val Tyr Asn Lys Gly Gly Asn Gly Val Ser Val Glu Ala Gln Thr Lys Gln Lys Asp Ser Leu Leu Asn
His Tyr Arg Glu Met Ile Arg Val Arg Gln Gln His Glu Glu Leu Val Lys Gly Thr Leu Gln Ser Ile
Leu Val Asp Ser Lys Glu Val Val Ala Tyr Ser Arg Thr Tyr Lys Asp Asn Ser Ile Ser Val Tyr His
Asn Ile Ser Asn Gln Pro Val Lys Val Ser Val Ala Ala Lys Gly Lys Leu Ile Phe Ala Ser Glu Lys
Gly Ala Lys Lys Val Lys Asn Gln Leu Val Ile Pro Ala Asn Thr Thr Val Leu Ile Lys

SEQ ID NO: 187

ttgtatctcatccaggaggggcacatgcgtttccgccattattcaccgccttaccggcctggccgttcgggttgagctctgcgtaccgcacag
agctgcggcataggggagtttgccgacttgccggttctgccgaattctgcaaaaaagccggatttgatctgtacagcttctccgggtcaatgac
accggcacagaaagttctccatacagcgcgcttctgcttgccttgccctgcacccgctgtatcaggtttccgacctgacctgaagcagcgggtttc
gaaaagcagattacagatctgaaaagccggttgaggacttgccctgttcagctatacggagctgcgccgtgccaaactggatatcctgcgtgc
agtgtttgataaaaaaaggaaccatcatcggcagtgccgaactggaagcctggatttcagataacccctggatcatcgaatatgcgggttttat
gaaccagaaacaccgcaacttgaagccggctggaacattgggaaaagctgcgaacccactcataacgaaatacaaaaaacctggcag
ggtaaaacctggcaggctgaccatcaattcttgcatggctgcagatgcggctggaccagcagtttactgccgccgtacagagtgcaacgcc
ctgggtgtctatcttaagggcgatatacctataatgatgaacgaggttccgcagatgcctgggcgaatccggaattctccgtgacgatcttcgg
gccggaagtcccccgtgacgggtgaaaacccccagggaacaaactggggcttccccattataactgggaaaaccttgcaaatgacgggtacag
ctggttggaaaaaacgtctgaagcacagcgcacgggtattaccatgcctaccgcattgaccatattcttgggttttccggatatgggtataccctat
ggcgaatactccggctacctgggatggcccttgccgatgaaccggtaagtgcagcagaactggcagaacggggcttttcaaggaccgctt
gcgctggcttaccgaacccccactgcctacacgggcagccgaggaagcgaataactgggactatctgggaacacacggctatctgaatcaga
tcataaccgatcgtgtaagaagaactatggctgttcaagcccagatcacctgcgaggcagatatacgaacacaaacctgccgatgcc
tgaaagaggttctgttacggcagtggaacacccgctgtgcaggttaccggccgcagcaaaaaaggacggacaacttactatccgctgtgg
cgtttccgtgacagcactgcatggcagacgcttaccgatggcgagaaacactccctggaagagctgttcgccccaaaaagcggcgcaaatga
aacctgtggcgagaacaggcgggtggaacttctgggtgagctgacgcgactacggatatgcttgcctgtgctgaagatctgggaagtattccc
cacagtgtaccggaagtgtttcaaacctttcaattacagtctgcgggttaccgcgtggcccgccaatgggatgccccggccagcccttca
cagactggaggagtatccgtcatgtcggtagcgaccccatcggttcatgattcctctaccctgcgcggatggtggaaaccgaagcgccgca
ccgggctttatggacgcatggcctccggaacaggatgcatacgcaggagcaggcccatgagttcgaaggcgctggggaccccgcca

Figure 16AAAA



ggcatcctgggtactccgtaaacctctgcgaagcccggtccgcgctctgtgttttccccatccaggatattttggccctgtctcagacttttatgcaat
gacagcggagcaggaacgcataatattccgggcagtgatccggatttaactggacataccggttgccctgcggcaatcgaggatttatctaaa
aacagccaactataaccgcaatccagaccgcgttgaggaccgccggcgagggaaggcacaaggagcacagcaatga

SEQ ID NO: 188

Met Tyr Leu Ile Gln Glu Gly His Met Arg Phe Pro Pro Ile Ile His Pro Leu Thr Gly Leu Ala Val Pro
Val Gly Ala Leu Arg Thr Ala Gln Ser Cys Gly Ile Gly Glu Phe Ala Asp Leu Pro Val Leu Ala Glu
Phe Cys Lys Lys Ala Gly Phe Asp Leu Val Gln Leu Leu Pro Val Asn Asp Thr Gly Thr Glu Ser Ser
Pro Tyr Ser Ala Leu Ser Ala Phe Ala Leu His Pro Leu Tyr Ile Arg Leu Ser Asp Leu Pro Glu Ala
Ala Gly Phe Glu Lys Gln Ile Thr Asp Leu Lys Ser Arg Phe Glu Asp Leu Pro Arg Phe Ser Tyr Thr
Glu Leu Arg Arg Ala Lys Leu Asp Ile Leu Arg Ala Val Phe Asp Lys Asn Lys Ala Thr Ile Ile Gly
Ser Ala Glu Leu Glu Ala Trp Ile Ser Asp Asn Pro Trp Ile Ile Glu Tyr Ala Val Phe Met Asn Gln
Lys His Arg Asn Phe Glu Ala Gly Trp Lys His Trp Glu Lys Leu Arg Asn Pro Thr His Asn Glu Ile
Gln Lys Thr Trp Gln Gly Lys Thr Trp Gln Ala Asp His Gln Phe Phe Ala Trp Leu Gln Met Arg Leu
Asp Gln Gln Phe Thr Ala Ala Ala Thr Glu Cys Asn Ala Leu Gly Val Tyr Leu Lys Gly Asp Ile Pro
Ile Met Met Asn Glu Asp Ser Ala Asp Ala Trp Ala Asn Pro Glu Phe Phe Arg Asp Asp Leu Arg
Ala Gly Ser Pro Pro Asp Gly Glu Asn Pro Gln Gly Gln Asn Trp Gly Phe Pro Ile Tyr Asn Trp Glu
Asn Leu Ala Asn Asp Gly Tyr Ser Trp Trp Lys Lys Arg Leu Lys His Ser Ala Arg Tyr Tyr His Ala
Tyr Arg Ile Asp His Ile Leu Gly Phe Phe Arg Ile Trp Ala Ile Pro Tyr Gly Glu Tyr Ser Gly Tyr Leu
Gly Trp Pro Leu Pro His Glu Pro Val Ser Ala Ala Glu Leu Ala Glu Arg Gly Phe Ser Lys Asp Arg
Leu Arg Trp Leu Thr Glu Pro His Leu Pro Thr Arg Ala Ala Glu Glu Ala Asn Asn Trp Asp Tyr Leu
Gly Thr His Gly Tyr Leu Asn Gln Ile Met Asn Arg Ile Gly Glu Glu Glu Leu Trp Leu Phe Lys Pro
Glu Ile Thr Cys Glu Ala Asp Ile Arg Asn Thr Asn Leu Pro Asp Ala Leu Lys Glu Val Leu Val Arg
Gln Trp Lys Asn Arg Leu Leu Gln Val Thr Gly Arg Asp Glu Lys Gly Arg Thr Ile Tyr Tyr Pro Leu
Trp Arg Phe Arg Asp Ser Thr Ala Trp Gln Thr Leu Thr Asp Gly Glu Lys His Ser Leu Glu Glu Leu
Phe Ala Gln Lys Ala Ala His Asn Glu Thr Leu Trp Arg Glu Gln Ala Val Glu Leu Leu Gly Glu Leu
Thr Arg Ser Thr Asp Met Leu Ala Cys Ala Glu Asp Leu Gly Ser Ile Pro His Ser Val Pro Glu Val
Leu Ser Asn Leu Ser Ile Tyr Ser Leu Arg Val Thr Arg Trp Ala Arg Gln Trp Asp Ala Pro Gly Gln
Pro Phe His Arg Leu Glu Glu Tyr Pro Leu Met Ser Val Ala Thr Pro Ser Val His Asp Ser Ser Thr
Leu Arg Gly Trp Trp Glu Thr Glu Gly Gly Asp Arg Ala Phe Met Asp Ala Trp Pro Pro Glu Gln
Asp Ala Tyr Ala Gly Ala Gly Arg His Glu Phe Glu Gly Ala Trp Gly Pro Arg Gln Ala Ser Trp Val
Leu Arg Lys Leu Cys Glu Ala Arg Ser Ala Leu Cys Val Phe Pro Ile Gln Asp Ile Leu Ala Leu Ser
Ser Asp Phe Tyr Ala Met Thr Ala Asp Glu Glu Arg Ile Asn Ile Pro Gly Ser Val Ser Gly Phe Asn
Trp Thr Tyr Arg Leu Pro Ala Ala Ile Glu Asp Leu Ser Lys Asn Ser Gln Leu Ile Thr Ala Ile Gln Thr
Ala Leu Gln Asp Arg Arg Ala Arg Lys Ala Gln Gly Ala Gln Gln

SEQ ID NO: 189

atgcaaacgattgcaaaaaaggggatgaacgatgaaagggaaaaaatggacagcttttagcttaacactgccgctggctgctagcttatca
acaggcgttcacgccgaaccgtacataaaggtaaatctccagctgcagataaaaacgggtgcttttatgaggtgatgtaaacctcttttacgatg
caaataaagatggacatggtgatttaaaaggcttacacaaaaactggactatttaaatgatggcaattctcatacaagaatgatcttcaagtaaa
cgggatttgatgatgccgatcaaccctctcctagctatcataaatatgatgtaacggactattataacattgattctcagtagcgaaatctgcaag
atttcgcaagctaataaagaagcagataaacgagatgtaaaagtattatggacctcgttgtaatcatagcagcagtgaaaccccttggttca
agctgcgttaaaaataaaaacagcaagtagacagattactatatttggcgtgataaaaataccgatttgaaatgaaaaaggatcttggggacaac
aagtagggcacaagctccaacggagagatttttacggaacgttctgggaagggaatgcctgacttaaatcagataaccctgaagtaagaaaa
gaaatgattaacgtcggaaagtgttggttaagcaaggcgttgacggcttccgcttagatgctgccctcatatctttaaagggtcaaacacctgaa
ggcgctaagaaaaatattgtgtggtggaatgaatttagagatgcgatgaaaaaagaaaacccgaacgtatatcctaacggcggaagtatgggatc
agccgggaagtgttagctccttattatcagtcgcttgattccctatttaactttgatttagcaggaaaaattgtcagctctgtaaaagcaggaaatgatc
aaggaaatcgctactgcagcagcggcaacgatgaactgttcaaatcatacaatccaaataaaattgacggcattttcttaaccaatcatgacaaa
atcgctcagtgatgagtaagcggagatgtcaataaagcaaaagtcagctgcctctatcttacttacgcttccctggaatccgtatatttaccggt
gaagaaatcggcatgaccggtgaaaagcctgatgaattaatccgtgaaccgttccgctggtacgaaggaaacggacttggacaaactagttgg

Figure 16BBBB



gaaacacctgtatacaataaaggcggcaacggcgtgtctgtagaagcacaaccaaacaaaaggactctttgttaaatcattaccgtgaaatgat
tcgcgtgcgtcagcagcagcaagagtagtaaaaggaacgcttcaatctatttcagtagacagtaaaagaattgttgcctatagccgtacgtataa
aggcaactccattagtgtgtatcataatatttcaaatcaacctgtaaaagtatctgtagcagcgaaaggtaaatgtattttgctagtgtgaaaagggtg
ctaaaaagggtcaaaaatcagcttgtgattccggcgaatacaacgggttttagtaaaaaaa

SEQ ID NO: 190

Met Gln Thr Ile Ala Lys Lys Gly Asp Glu Thr Met Lys Gly Lys Lys Trp Thr Ala Leu Ala Leu Thr
Leu Pro Leu Ala Ala Ser Leu Ser Thr Gly Val His Ala Glu Thr Val His Lys Gly Lys Ser Pro Ala
Ala Asp Lys Asn Gly Val Phe Tyr Glu Val Tyr Val Asn Ser Phe Tyr Asp Ala Asn Lys Asp Gly His
Gly Asp Leu Lys Gly Leu Thr Gln Lys Leu Asp Tyr Leu Asn Asp Gly Asn Ser His Thr Lys Asn
Asp Leu Gln Val Asn Gly Ile Trp Met Met Pro Ile Asn Pro Ser Pro Ser Tyr His Lys Tyr Asp Val
Thr Asp Tyr Tyr Asn Ile Asp Ser Gln Tyr Gly Asn Leu Gln Asp Phe Arg Lys Leu Met Lys Glu Ala
Asp Lys Arg Asp Val Lys Val Ile Met Asp Leu Val Val Asn His Thr Ser Ser Glu His Pro Trp Phe
Gln Ala Ala Leu Lys Asp Lys Asn Ser Lys Tyr Arg Asp Tyr Tyr Ile Trp Ala Asp Lys Asn Thr Asp
Leu Asn Glu Lys Gly Ser Trp Gly Gln Gln Val Trp His Lys Ala Pro Asn Gly Glu Tyr Phe Tyr Gly
Thr Phe Trp Glu Gly Met Pro Asp Leu Asn Tyr Asp Asn Pro Glu Val Arg Lys Glu Met Ile Asn Val
Gly Lys Phe Trp Leu Lys Gln Gly Val Asp Gly Phe Arg Leu Asp Ala Ala Leu His Ile Phe Lys Gly
Gln Thr Pro Glu Gly Ala Lys Lys Asn Ile Val Trp Trp Asn Glu Phe Arg Asp Ala Met Lys Lys Glu
Asn Pro Asn Val Tyr Leu Thr Gly Glu Val Trp Asp Gln Pro Glu Val Val Ala Pro Tyr Tyr Gln Ser
Leu Asp Ser Leu Phe Asn Phe Asp Leu Ala Gly Lys Ile Val Ser Ser Val Lys Ala Gly Asn Asp Gln
Gly Ile Ala Thr Ala Ala Ala Ala Thr Asp Glu Leu Phe Lys Ser Tyr Asn Pro Asn Lys Ile Asp Gly
Ile Phe Leu Thr Asn His Asp Gln Asn Arg Val Met Ser Glu Leu Ser Gly Asp Val Asn Lys Ala Lys
Ser Ala Ala Ser Ile Leu Leu Thr Leu Pro Gly Asn Pro Tyr Ile Tyr Tyr Gly Glu Glu Ile Gly Met Thr
Gly Glu Lys Pro Asp Glu Leu Ile Arg Glu Pro Phe Arg Trp Tyr Glu Gly Asn Gly Leu Gly Gln Thr
Ser Trp Glu Thr Pro Val Tyr Asn Lys Gly Gly Asn Gly Val Ser Val Glu Ala Gln Thr Lys Gln Lys
Asp Ser Leu Leu Asn His Tyr Arg Glu Met Ile Arg Val Arg Gln Gln His Glu Glu Leu Val Lys Gly
Thr Leu Gln Ser Ile Ser Val Asp Ser Lys Glu Val Val Ala Tyr Ser Arg Thr Tyr Lys Gly Asn Ser Ile
Ser Val Tyr His Asn Ile Ser Asn Gln Pro Val Lys Val Ser Val Ala Ala Lys Gly Lys Leu Ile Phe Ala
Ser Glu Lys Gly Ala Lys Lys Val Lys Asn Gln Leu Val Ile Pro Ala Asn Thr Thr Val Leu Val Lys

SEQ ID NO: 191

atgcaaacgattgcaaaaaaggggatgaacgatgaaagggaataatggacagctttagcttaacactgccgtggtgctagcttatca
acaggcgttcacgccgaaaccgtacataaaggtaaatctccaacagcagataaaaacgggtgtctttatgaagtgtatgtaaacctttttacgatg
caataaagatggagctggtagcttaaaaggcttacacaaaagttggactatttaaatgacggcaattctcatcaaaaaaatgatcttcaagtaaa
cgggatttggatgagccagtcacaccttctcctagctatcataaatatgatgtaacggactattataacattgatccgcagtagcgaatctgcaa
gattttcgcaagctgatgaaagaagcagacaaacgagacgtaaaagtcattatggacctgtgtgaatcatagcagcagtgaaacaccttggtt
caagctgcgttaaaagataaaaacagcaagtagacagattactatatttggcgtgataaaaaataccgacttgaatgaaaaggatcttggggaca
acaagtagtgacataaagctccaaacggagagatttttacggaacgttctgggaagggaatgacctgaattacgataacctgaagtaagaa
aagaaatgattaacgtcggaagttttggctaaagcaaggcgttgacgggtccgcttagatgctgcgttcataatttttaagggtcaaacagctga
aggcgtgaagaaaaatctctgtgtggaatgagtttagatgcgatgaaaaagaaaatcgaatgtatatctaacgggtgaagtagggat
cagcctgaagtggtagctccttattatcaatcgttgattcttttatttattttgatttagcaggaaaaattgtcagctctgtaaaagcaggaaatgatc
aaggaatgccactgcagcagcagcaacagatgaactgttcaaatcatacaatccaacaaaattgatggcatattcttaaccaaccatgacca
aatcgcgtcatgagtgcgtgagcggcgatgtgagcaaaacaaatcagctgcttcttacttacgcttcttggcaacccgtatatttattacg
gtgaagaaatcgccatgaccgggtgaaaagcctgatgaattaatccgtgaaccgttccgctggtacgaaggaaacggacttggacaaaccagtt
gggaaacacctgtatacaataaaggcggaaacgggtgtgtctgtagaagcacaacaaacaaaaggattctttgttaaatcattaccgtgaaatg
attcgcgtgcgcagcagcatgaagagtagtaaaaggaacgcttcaatctatttcagtagacagtaaaagaattgttgcctatagccgtacgtata
aaggcaactccattagtgtgtatcataatatttcaaatcaaccggtaaaagtatctgtagcagcgaaaggtaaatgtattttgctagtgtgaaaagggt
gctaagaaagtcaaaaatcagcttgtgttccggcgaatacaacgggttttaataaataa

SEQ ID NO: 192

Figure 16CCCC



Met Gln Thr Ile Ala Lys Lys Gly Asp Glu Thr Met Lys Gly Lys Lys Trp Thr Ala Leu Ala Leu Thr
Leu Pro Leu Ala Ala Ser Leu Ser Thr Gly Val His Ala Glu Thr Val His Lys Gly Lys Ser Pro Thr
Ala Asp Lys Asn Gly Val Phe Tyr Glu Val Tyr Val Asn Ser Phe Tyr Asp Ala Asn Lys Asp Gly His
Gly Asp Leu Lys Gly Leu Thr Gln Lys Leu Asp Tyr Leu Asn Asp Gly Asn Ser His Thr Lys Asn
Asp Leu Gln Val Asn Gly Ile Trp Met Met Pro Val Asn Pro Ser Pro Ser Tyr His Lys Tyr Asp Val
Thr Asp Tyr Tyr Asn Ile Asp Pro Gln Tyr Gly Asn Leu Gln Asp Phe Arg Lys Leu Met Lys Glu Ala
Asp Lys Arg Asp Val Lys Val Ile Met Asp Leu Val Val Asn His Thr Ser Ser Glu His Pro Trp Phe
Gln Ala Ala Leu Lys Asp Lys Asn Ser Lys Tyr Arg Asp Tyr Tyr Ile Trp Ala Asp Lys Asn Thr Asp
Leu Asn Glu Lys Gly Ser Trp Gly Gln Gln Val Trp His Lys Ala Pro Asn Gly Glu Tyr Phe Tyr Gly
Thr Phe Trp Glu Gly Met Pro Asp Leu Asn Tyr Asp Asn Pro Glu Val Arg Lys Glu Met Ile Asn Val
Gly Lys Phe Trp Leu Lys Gln Gly Val Asp Gly Phe Arg Leu Asp Ala Ala Leu His Ile Phe Lys Gly
Gln Thr Ala Glu Gly Ala Lys Lys Asn Ile Leu Trp Trp Asn Glu Phe Arg Asp Ala Met Lys Lys Glu
Asn Pro Asn Val Tyr Leu Thr Gly Glu Val Trp Asp Gln Pro Glu Val Val Ala Pro Tyr Tyr Gln Ser
Leu Asp Ser Leu Phe Asn Phe Asp Leu Ala Gly Lys Ile Val Ser Ser Val Lys Ala Gly Asn Asp Gln
Gly Ile Ala Thr Ala Ala Ala Thr Asp Glu Leu Phe Lys Ser Tyr Asn Pro Asn Lys Ile Asp Gly
Ile Phe Leu Thr Asn His Asp Gln Asn Arg Val Met Ser Glu Leu Ser Gly Asp Val Ser Lys Ala Lys
Ser Ala Ala Ser Ile Leu Leu Thr Leu Pro Gly Asn Pro Tyr Ile Tyr Tyr Gly Glu Glu Ile Gly Met Thr
Gly Glu Lys Pro Asp Glu Leu Ile Arg Glu Pro Phe Arg Trp Tyr Glu Gly Asn Gly Leu Gly Gln Thr
Ser Trp Glu Thr Pro Val Tyr Asn Lys Gly Gly Asn Gly Val Ser Val Glu Ala Gln Thr Lys Gln Lys
Asp Ser Leu Leu Asn His Tyr Arg Glu Met Ile Arg Val Arg Gln Gln His Glu Glu Leu Val Lys Gly
Thr Leu Gln Ser Ile Ser Val Asp Ser Lys Glu Val Val Ala Tyr Ser Arg Thr Tyr Lys Gly Asn Ser Ile
Ser Val Tyr His Asn Ile Ser Asn Gln Pro Val Lys Val Ser Val Ala Ala Lys Gly Lys Leu Ile Phe Ala
Ser Glu Lys Gly Ala Lys Lys Val Lys Asn Gln Leu Val Val Pro Ala Asn Thr Thr Val Leu Met Lys

SEQ ID NO: 193

atgaaattcaaaaagatttatctgccgggctcctttgttcggagggtctgagcgggtgtgacaccatccgtcgtcggagggtgccacgaaccgc
attgtccatttattcgaatggagttggccggaattgccaccgaatgcgaacctttcttgccctaagggttctctcgggttcagggtgtctccgc
cgcaaaaaagcgtcgaatgctgcctggtgggcgcgctaccaacctgttagttactctttgaaggcgagtggaacccgggctcaattgc
ggatatggtccagcgttgaagcgggtgggggtcgatatttatctggatgaggtgatcaacatattggcagcacaagatcgctattttcagaagt
acctacagcagtaatgattttcacagttgcacgggcgatatcgattattccaaccgctggctgattcaaaattgcgactctggttgggctgaacgat
ctcaaaaccgagtcagaatacgttcggcagaaaattgcagactatatgaacgatgcgctcagctctgggcgtggcggttctcgattgatccg
ccaagcatatcccgccggcgacatcgccgatcaagagcaagctcaacggcagcccgatatactatcaggagggttatcgggcgccgagg
ggagccggtacaaaccagcagtagacacgtatattggagacgtgacggaatttaacttcgcccggaccatcgggctaaatttaagcaaggtaat
attaaagacctgcaggggattggtcgtggagcggctggtgagcagcgacgatcggtgacctttgtaccaacctgacgaagaacgcca
taacctggccaggttctcagccatcaggactttggcaatctgtatttctcggtaacgtgttactctggcgatccttacggctacccaaaagtga
tgtcgggtactacttcagtaattttgatgccgggcccaccatcgacaggggtacattctggttaatgcgtgtggctttgatggcggtgattgggtctg
cgaacacaaatggcgtggttagccaacatggtggcggttcgcaaccacacagcagcccagtgagggtcactgactggtgggacgatggtt
acaatcaggtggcggttggctggtggcggtgggctttgtggtgatcaatcgagatgacaataaaggcatcaatcagatttcagacgggaat
gcccgtggcgagttatgtacatcattgccggtgatttcgacaccagagcggtcattgcagcgctacgacgatcaccgtcgacagtcaggg
gtatgcacattttactgtcggtatgcatcaggccgctgcgattcacattggcgcgaaactcggtccgtgtgccaggactgtggcgccacggcc
gcagagacaaaagtctgcttgacaatgcacaaaacttagccaaccgtatttgcattactggaatgtcaatgcggatcaggccgtagcgaatgc
aacctggccgggctgcgatgacggctgaaaatggcggttactgtacgattttggtgtcggtctcaattcattcaggttaatttcagcgataa
cggcgcagccaaaccgctgatctgaccgcagcagtcggacgttgtgttaccagaacggaacgtggcggtgacagtgacttctgtcagagta
gcaatgtgggcacagagatttggtatttccgtggaacctcaaacggttggggcggtgagcgcactcacttatgaggctgcgacaggcctgtaca
ctacggtgcagagcttaacggggaggagtcgcccgcacgctttaaattgatgatggcaactggagtgagtcgatccaagtgtgattatcaa
gtcgggtgattatgccacctacagatcacgtttgacagccagacgaaggccatcaccgtgacttcgcagtaa

SEQ ID NO: 194

Met Lys Phe Lys Lys Ser Leu Ser Ala Gly Leu Leu Leu Phe Gly Gly Leu Ser Gly Val Thr Pro Ser
Val Ala Ala Glu Val Pro Arg Thr Ala Phe Val His Leu Phe Glu Trp Ser Trp Pro Asp Ile Ala Thr

Figure 16DDDD



Glu Cys Glu Thr Phe Leu Gly Pro Lys Gly Phe Ser Ala Val Gln Val Ser Pro Pro Gln Lys Ser Val
Ser Asn Ala Ala Trp Trp Ala Arg Tyr Gln Pro Val Ser Tyr Ser Phe Glu Gly Arg Ser Gly Thr Arg
Ala Gln Phe Ala Asp Met Val Gln Arg Cys Lys Ala Val Gly Val Asp Ile Tyr Leu Asp Ala Val Ile
Asn His Met Ala Ala Gln Asp Arg Tyr Phe Pro Glu Val Pro Tyr Ser Ser Asn Asp Phe His Ser Cys
Thr Gly Asp Ile Asp Tyr Ser Asn Arg Trp Ser Ile Gln Asn Cys Asp Leu Val Gly Leu Asn Asp Leu
Lys Thr Glu Ser Glu Tyr Val Arg Gln Lys Ile Ala Asp Tyr Met Asn Asp Ala Leu Ser Leu Gly Val
Ala Gly Phe Arg Ile Asp Ala Ala Lys His Ile Pro Ala Gly Asp Ile Ala Ala Ile Lys Ser Lys Leu Asn
Gly Ser Pro Tyr Ile Tyr Gln Glu Val Ile Gly Ala Ala Gly Glu Pro Val Gln Thr Ser Glu Tyr Thr Tyr
Ile Gly Asp Val Thr Glu Phe Asn Phe Ala Arg Thr Ile Gly Pro Lys Phe Lys Gln Gly Asn Ile Lys
Asp Leu Gln Gly Ile Gly Ser Trp Ser Gly Trp Leu Ser Ser Asp Asp Ala Val Thr Phe Val Thr Asn
His Asp Glu Glu Arg His Asn Pro Gly Gln Val Leu Ser His Gln Asp Phe Gly Asn Leu Tyr Phe Leu
Gly Asn Val Phe Thr Leu Ala Tyr Pro Tyr Gly Tyr Pro Lys Val Met Ser Gly Tyr Tyr Phe Ser Asn
Phe Asp Ala Gly Pro Pro Ser Thr Gly Val His Ser Gly Asn Ala Cys Gly Phe Asp Gly Gly Asp Trp
Val Cys Glu His Lys Trp Arg Gly Val Ala Asn Met Val Ala Phe Arg Asn His Thr Ala Ala Gln Trp
Gln Val Thr Asp Trp Trp Asp Asp Gly Tyr Asn Gln Val Ala Phe Gly Arg Gly Gly Leu Gly Phe
Val Val Ile Asn Arg Asp Asp Asn Lys Gly Ile Asn Gln Ser Phe Gln Thr Gly Met Pro Ala Gly Glu
Tyr Cys Asp Ile Ile Ala Gly Asp Phe Asp Thr Gln Ser Gly His Cys Ser Ala Thr Thr Ile Thr Val
Asp Ser Gln Gly Tyr Ala His Phe Thr Val Gly Ser His Gln Ala Ala Ala Ile His Ile Gly Ala Lys Leu
Gly Ser Val Cys Gln Asp Cys Gly Gly Thr Ala Ala Glu Thr Lys Val Cys Phe Asp Asn Ala Gln
Asn Phe Ser Gln Pro Tyr Leu His Tyr Trp Asn Val Asn Ala Asp Gln Ala Val Ala Asn Ala Thr Trp
Pro Gly Val Ala Met Thr Ala Glu Asn Gly Gly Tyr Cys Tyr Asp Phe Gly Val Gly Leu Asn Ser Leu
Gln Val Ile Phe Ser Asp Asn Gly Ala Ser Gln Thr Ala Asp Leu Thr Ala Ser Ser Pro Thr Leu Cys
Tyr Gln Asn Gly Thr Trp Arg Asp Ser Asp Phe Cys Gln Ser Ser Asn Val Gly Asn Glu Ser Trp Tyr
Phe Arg Gly Thr Ser Asn Gly Trp Gly Val Ser Ala Leu Thr Tyr Glu Ala Ala Thr Gly Leu Tyr Thr
Thr Val Gln Ser Phe Asn Gly Glu Glu Ser Pro Ala Arg Phe Lys Ile Asp Asp Gly Asn Trp Ser Glu
Ser Tyr Pro Ser Ala Asp Tyr Gln Val Gly Asp Tyr Ala Thr Tyr Thr Ile Thr Phe Asp Ser Gln Thr
Lys Ala Ile Thr Val Thr Ser Gln

SEQ ID NO: 195

atgctgacagaccggtttcttggatggcgatacatcaaacacgacccttacaaccagaactacgatgctaaaaacgaccggggaacttatcagg
ggcgcgattttaaaggaatcacgcaaaaattggattatctcgataagctaggcgtgaacacaaatctggatcagcccgatcgtggaaaatatcaag
catgatgtccgttatgacaactctgaagggcattcactatgcttaccacggctactgggcaagcaacttcggtgcgttaaaccacacttcggt
acaatggaagatttccatacactgattgacgctgcccataaaaaaggcatcaagatcatggttgacgtagtattaaaccacactggttatggctta
aaagatatcaacggagaaagtttccaatctccagccggttacccaactgacgcagaacgcagcacatatagcagcctgcttcgccagggttca
aatgtcggctctgatgaggttggcgaattagctggcctacctgacttaaaaacagaagaccccgagtcgccagacaatcatcgactggc
aacagactggatcacgaaagctactacagctaaaggaaacacaattgactacttcggtgcgacactgtgaagcacgttgaagacgcaacat
ggatggcattcaaaaatgacctcactgaaaaatgccgacacacaaaatgatcggggaagcttggggagcaagtggccaataaccaactggat
acctgaaacaggtatgatggactcactgcttgacttcgacttcaaaaggcattgcgcacgatttcgtgaacggcaagcttaaggcagcaaacgat
gcccgtactgcccgaacggtaaaattgacaacacagctactttaggttcattccttggagccatgacgaagatggtttcatttaagaagga
aatgacaaggcaagcttaaggttctgcttcctgcaagcaacatcaaaaggccagccggtcatctattatggtgaagagcttggtcaaaagt
gagcaaaacactatccgcaatacgaataccggttatgacctggcatgggacaaggtgaaaacaacgacgtccttgagcactacactaaggtcct
gaacttcagaagcgctcattcagaaggttgcgttaaaggtgaacgcgcaacaattggcgggttcgacgctgataaattctacttttgcctgtaa
aatgaaacgaagctgctacgtcggtgaacgttgctgacacagcaaaagacgtaacactgactgtttcgcaggtgcagtcgtaactgacc
actatgcagataaaacttatactgctcagaagctggagaaatcacattgacgatcccggaagctgatggcggctactgttttactaacggttg
aaggcgggagaaatcacagctgctaagcggcgaagcggaaggcgacggcacaggtgagccagtcctcgcaaccacatccgcattcactaca
ccgtacagacaacaactatgaaaactacgggtcatggctgtggaacgatgtagcctcccccttgcgaactggccgactggcgctacaatgtttg
aaaaaacagacagctacgggtgcatacatcgacgtaccacttaaaaggggcgtaagaacatcggttcctcgttatggatgatacaaaaagggtga
tcagggtaaagcggcggcgcaaaaggttttacgatctcatcactgaaatgaacgaaatttgatcaagcaaggttctgacaaggtgtacactt
acgagccagttgatcttcggcgcaacactgtccgcgtccactatgtacgtgacaacgcagactacgaaaactcgggtatggaactggggcgga
tgaacagcacctccgaaaactggcctacaggcgacgcgaaattcgatggtacagaccgttacggtgcgtatgtcgacattacgctaaaaagaa

Figure 16EEEE



Applicant(s): Walter Callen et al.
ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

ggcgcaagaacattggaatgattgctttaacactgcaaatggagagaaagacggcgagataaatccttcaaccttctggataaatataatcg
catttgattaaacaaggtgatgacaatgtctacgtttctccatactgggagcaggcaacaggaatcaccaatgcagaggtaatctctgaagata
cgattctattaggcttcacaatgactgacggcttaacacctgaatctttaaaaggaggtcttgaattaaagattcaactgggtgctgaagtggccatc
gaaagtgcgaaatcacaagcgcaacctctgtaaaagttaaaagcaacattcgatttagaaaagctccattatccatcacatagcaggcagaac
agtttcagcttcaactggctggagaatgcttgatgaaatgtacgcttatgatgaaacgacctgggtgcgactacaaggacggagcagcgacg
cttaattatgggctccgaaagcgagcaaggaaccgtaactctttgataaaaaatagccgctgaaaaaatcggcagcgtcgagttaacgaa
gggtgaaaaaggagctggtcagctatggtgctcctggcgacctgaacgtaaccgatcttgaaggttattttaccagtatgatgtaacaaatga
cgggtataactcgccaggtgttagtccttatgcaaatcaatggcgaccttactgtgaatacagaaggcaatgctggtcctgacggggacactg
ttggcaaggcggaattcaaaaagcttctcgagagtacttctag

SEQ ID NO: 196

Met Leu Thr Asp Arg Phe Phe Asp Gly Asp Thr Ser Asn Asn Asp Pro Tyr Asn Gln Asn Tyr Asp
Ala Lys Asn Asp Arg Gly Thr Tyr Gln Gly Gly Asp Phe Lys Gly Ile Thr Gln Lys Leu Asp Tyr Leu
Asp Lys Leu Gly Val Asn Thr Ile Trp Ile Ser Pro Ile Val Glu Asn Ile Lys His Asp Val Arg Tyr Asp
Asn Ser Glu Gly His Ser Tyr Tyr Ala Tyr His Gly Tyr Trp Ala Ser Asn Phe Gly Ala Leu Asn Pro
His Phe Gly Thr Met Glu Asp Phe His Thr Leu Ile Asp Ala Ala His Glu Lys Gly Ile Lys Ile Met
Val Asp Val Val Leu Asn His Thr Gly Tyr Gly Leu Lys Asp Ile Asn Gly Glu Val Ser Asn Pro Pro
Ala Gly Tyr Pro Thr Asp Ala Glu Arg Ser Thr Tyr Ser Ser Leu Leu Arg Gln Gly Ser Asn Val Gly
Ser Asp Glu Val Val Gly Glu Leu Ala Gly Leu Pro Asp Leu Lys Thr Glu Asp Pro Ala Val Arg Gln
Thr Ile Ile Asp Trp Gln Thr Asp Trp Ile Thr Lys Ala Thr Thr Ala Lys Gly Asn Thr Ile Asp Tyr Phe
Arg Val Asp Thr Val Lys His Val Glu Asp Ala Thr Trp Met Ala Phe Lys Asn Asp Leu Thr Glu
Lys Met Pro Thr His Lys Met Ile Gly Glu Ala Trp Gly Ala Ser Ala Asn Asn Gln Leu Gly Tyr Leu
Glu Thr Gly Met Met Asp Ser Leu Leu Asp Phe Asp Phe Lys Gly Ile Ala His Asp Phe Val Asn Gly
Lys Leu Lys Ala Ala Asn Asp Ala Leu Thr Ala Arg Asn Gly Lys Ile Asp Asn Thr Ala Thr Leu Gly
Ser Phe Leu Gly Ser His Asp Glu Asp Gly Phe Leu Phe Lys Glu Gly Asn Asp Lys Gly Lys Leu
Lys Val Ala Ala Ser Leu Gln Ala Thr Ser Lys Gly Gln Pro Val Ile Tyr Tyr Gly Glu Glu Leu Gly
Gln Ser Gly Ala Asn Asn Tyr Pro Gln Tyr Asp Asn Arg Tyr Asp Leu Ala Trp Asp Lys Val Glu
Asn Asn Asp Val Leu Glu His Tyr Thr Lys Val Leu Asn Phe Arg Ser Ala His Ser Glu Val Phe Ala
Lys Gly Glu Arg Ala Thr Ile Gly Gly Ser Asp Ala Asp Lys Phe Leu Leu Phe Ala Arg Lys Asn Gly
Asn Glu Ala Ala Tyr Val Gly Leu Asn Val Ala Asp Thr Ala Lys Asp Val Thr Leu Thr Val Ser Ala
Gly Ala Val Val Thr Asp His Tyr Ala Asp Lys Thr Tyr Thr Ala Ser Glu Ala Gly Glu Ile Thr Leu
Thr Ile Pro Ala Lys Ala Asp Gly Gly Thr Val Leu Leu Thr Val Glu Gly Gly Glu Ile Thr Ala Ala
Lys Ala Ala Ser Glu Gly Asp Gly Thr Val Glu Pro Val Pro Ala Asn His Ile Arg Ile His Tyr Asn
Arg Thr Asp Asn Asn Tyr Glu Asn Tyr Gly Ala Trp Leu Trp Asn Asp Val Ala Ser Pro Ser Ala Asn
Trp Pro Thr Gly Ala Thr Met Phe Glu Lys Thr Asp Ser Tyr Gly Ala Tyr Ile Asp Val Pro Leu Lys
Glu Gly Ala Lys Asn Ile Gly Phe Leu Val Met Asp Val Thr Lys Gly Asp Gln Gly Lys Asp Gly Gly
Asp Lys Gly Phe Thr Ile Ser Ser Pro Glu Met Asn Glu Ile Trp Ile Lys Gln Gly Ser Asp Lys Val
Tyr Thr Tyr Glu Pro Val Asp Leu Pro Ala Asn Thr Val Arg Val His Tyr Val Arg Asp Asn Ala Asp
Tyr Glu Asn Phe Gly Ile Trp Asn Trp Gly Asp Val Thr Ala Pro Ser Glu Asn Trp Pro Thr Gly Ala
Ala Lys Phe Asp Gly Thr Asp Arg Tyr Gly Ala Tyr Val Asp Ile Thr Leu Lys Glu Gly Ala Lys Asn
Ile Gly Met Ile Ala Leu Asn Thr Ala Asn Gly Glu Lys Asp Gly Gly Asp Lys Ser Phe Asn Leu Leu
Asp Lys Tyr Asn Arg Ile Trp Ile Lys Gln Gly Asp Asp Asn Val Tyr Val Ser Pro Tyr Trp Glu Gln
Ala Thr Gly Ile Thr Asn Ala Glu Val Ile Ser Glu Asp Thr Ile Leu Leu Gly Phe Thr Met Thr Asp
Gly Leu Thr Pro Glu Ser Leu Lys Gly Gly Leu Val Ile Lys Asp Ser Thr Gly Ala Glu Val Ala Ile
Glu Ser Ala Glu Ile Thr Ser Ala Thr Ser Val Lys Val Lys Ala Thr Phe Asp Leu Glu Lys Leu Pro
Leu Ser Ile Thr Tyr Ala Gly Arg Thr Val Ser Ala Ser Thr Gly Trp Arg Met Leu Asp Glu Met Tyr
Ala Tyr Asp Gly Asn Asp Leu Gly Ala Thr Tyr Lys Asp Gly Ala Ala Thr Leu Lys Leu Trp Ala Pro
Lys Ala Ser Lys Val Thr Ala Asn Phe Phe Asp Lys Asn Asn Ala Ala Glu Lys Ile Gly Ser Val Glu
Leu Thr Lys Gly Glu Lys Gly Val Trp Ser Ala Met Val Ala Pro Gly Asp Leu Asn Val Thr Asp Leu
Glu Gly Tyr Phe Tyr Gln Tyr Asp Val Thr Asn Asp Gly Ile Thr Arg Gln Val Leu Asp Pro Tyr Ala

Figure 16FFFF



Lys Ser Met Ala Ala Phe Thr Val Asn Thr Glu Gly Asn Ala Gly Pro Asp Gly Asp Thr Val Gly Lys
Ala Ala Ile Gln Lys Ala Ser Arg Glu Tyr Phe

SEQ ID NO: 197

atgaaaccgtcaaaattcgttttctctctgctgccatcgcttgacgctctccagtagcccaatgctgacgccatttgcattgcaattgaag
tactccgacgtcacgcaaaacgctcgcgaatcgcgccggcggttataaaaaagtgtgatttgcgcagcactgaaatcgagtggcaatgaa
tggtgggcacgttatcaaccgcaagatctgcgcgtgatcgattccccacttggcaacaaaagtgaactaaaatccatgattgatgctctgaaggc
ggcggcggtgatgtgatgccgatgtggtgcttaaccatagggcaatgaacatggaagcgtgaagactaaatccctggcagtgaaatgc
lgcaacaatacgcagctaacaccagttattatgcggaccaaacgcttttggcaatttaacgaaaacctattctctggcttgaactccaccaga
aggtctgtattagcgattggaatgatgccggcaatgttcagtagctggcgtcttggcggtgctggtgaccgagggctgccagacttagatccga
acaactgggtggtgtcacagcaacgtttgtattgaatgcgctaaaagggttaggtgtgaaaggctccgcattgatcggttaaacacatgagcc
aatatcaaatcgaccagatttctactgcagagattaccgcccgaatgcacgtgttgggtgaagtgtaccagtggtggcaaggcgactccag
ctatgagaacttcttagcgccttatctcaacgccaccaaccattcggttacgatttccactgttgcctctattcgaacgccttctctacagcg
tgcatgaacatgcttcatgatccacaagcctatggccaagggttgaaacgcacgttcaattacccttaccatcacgcacacatcccaacga
acgacggtttccgttatcaaatcatggatccgaaagatgaagactggcttacgcttatactcgtgaaagatggcgccacacctctgattaca
gcgacaacttacctgataacgaagatcgatgataatcgccgttgggaagggtgttgaaccgtgacctgatgaagaacatgttgcgttccataac
caatgaaggcgcaagagatgacgatgctgtacagcgaccaatgtctactgatgtttaaagcgcggtgaaacaagggtgtgctggcattaataat
gcggtgaagagcggttctacacgttgacacctatcagcatgagttcaactggtatcagccttacacagatacactcactggcgtgactgaaacc
tgaggttcgcgttaccacacctccgaattccagctcgacgcgcgcgatgtacatgctctaa

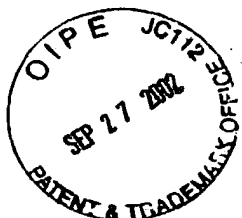
SEQ ID NO: 198

Met Lys Pro Ser Lys Phe Val Phe Leu Ser Ala Ala Ile Ala Cys Ser Leu Ser Ser Thr Ala Asn Ala
Asp Ala Ile Leu His Ala Phe Asn Trp Lys Tyr Ser Asp Val Thr Gln Asn Ala Ser Gln Ile Ala Ala
Ala Gly Tyr Lys Lys Val Leu Ile Ser Pro Ala Leu Lys Ser Ser Gly Asn Glu Trp Trp Ala Arg Tyr
Gln Pro Gln Asp Leu Arg Val Ile Asp Ser Pro Leu Gly Asn Lys Ser Asp Leu Lys Ser Met Ile Asp
Ala Leu Lys Ala Val Gly Val Asp Val Tyr Ala Asp Val Val Leu Asn His Met Ala Asn Glu Thr Trp
Lys Arg Glu Asp Leu Asn Tyr Pro Gly Ser Glu Val Leu Gln Gln Tyr Ala Ala Asn Thr Ser Tyr Tyr
Ala Asp Gln Thr Leu Phe Gly Asn Leu Thr Glu Asn Leu Phe Ser Gly Phe Asp Phe His Pro Glu
Gly Cys Ile Ser Asp Trp Asn Asp Ala Gly Asn Val Gln Tyr Trp Arg Leu Cys Gly Gly Ala Gly Asp
Arg Gly Leu Pro Asp Leu Asp Pro Asn Asn Trp Val Val Ser Gln Gln Arg Leu Tyr Leu Asn Ala
Leu Lys Gly Leu Gly Val Lys Gly Phe Arg Ile Asp Ala Val Lys His Met Ser Gln Tyr Gln Ile Asp
Gln Ile Phe Thr Ala Glu Ile Thr Ala Gly Met His Val Phe Gly Glu Val Ile Thr Ser Gly Gly Lys Gly
Asp Ser Ser Tyr Glu Asn Phe Leu Ala Pro Tyr Leu Asn Ala Thr Asn His Ser Ala Tyr Asp Phe Pro
Leu Phe Ala Ser Ile Arg Asn Ala Phe Ser Tyr Ser Gly Gly Met Asn Met Leu His Asp Pro Gln Ala
Tyr Gly Gln Gly Leu Glu Asn Ala Arg Ser Ile Thr Phe Thr Ile Thr His Asp Ile Pro Thr Asn Asp
Gly Phe Arg Tyr Gln Ile Met Asp Pro Lys Asp Glu Glu Leu Ala Tyr Ala Tyr Ile Leu Gly Lys Asp
Gly Gly Thr Pro Leu Ile Tyr Ser Asp Asn Leu Pro Asp Asn Glu Asp Arg Asp Asn Arg Arg Trp
Glu Gly Val Trp Asn Arg Asp Leu Met Lys Asn Met Leu Arg Phe His Asn Gln Met Gln Gly Gln
Glu Met Thr Met Leu Tyr Ser Asp Gln Cys Leu Leu Met Phe Lys Arg Gly Lys Gln Gly Val Val
Gly Ile Asn Lys Cys Gly Glu Glu Arg Ser His Thr Val Asp Thr Tyr Gln His Glu Phe Asn Trp Tyr
Gln Pro Tyr Thr Asp Thr Leu Thr Gly Val Thr Glu Thr Val Ser Ser Arg Tyr His Thr Phe Arg Ile
Pro Ala Arg Ser Ala Arg Met Tyr Met Leu

SEQ ID NO: 199

gtgagtttgacaaaaaggctcagtagcaaccaaatacggcaccaaggctcagtagcatctctgcaatcaatgccgcgcacacaacaatatcca
aattacggcgatgttgtgttaaccaccgaggtggtgctgatgggaagtcgtgggtcgataccaagcgcggttgattgggacaaccgcaatattg
aactggcgacaaatggattgaagcttgggttgagtttaatttcttggccgcaacgacaaatactcgaacttccattggacttggatcactttgac
gggttgactgggatgacggcgcaagaaaaagcgatcttaaatcaaaaggcggaaggaaaagcatgggattgggaagtcagctctgaaaa
aggcaattacgactacctaa

Figure 16GGGG



Applicant(s): Walter Callen et al.
ENZYMES HAVING ALPHA AMYLASE ACTIVITY AND
METHODS OF USE THEREOF

SEQ ID NO: 200

Val Ser Leu Thr Lys Lys Ala Gln Tyr Glu Pro Asn Thr Ala Pro Arg Leu Ser Thr Ser Leu Gln Ser
Met Pro Arg Thr Thr Thr Ile Ser Lys Phe Thr Ala Met Leu Cys Leu Thr Thr Glu Val Val Leu Met
Gly Ser Arg Gly Ser Ile Pro Ser Ala Leu Ile Gly Thr Thr Ala Ile Leu Asn Trp Ala Thr Asn Gly Leu
Lys Leu Gly Leu Ser Leu Ile Phe Leu Ala Ala Thr Thr Asn Thr Arg Thr Ser Ile Gly Leu Gly Ile
Thr Leu Thr Val Leu Thr Gly Met Thr Pro Ala Lys Lys Lys Arg Ser Leu Asn Ser Lys Ala Lys Glu
Lys His Gly Ile Gly Lys Ser Ala Leu Lys Lys Ala Ile Thr Thr Thr

SEQ ID NO: 201

atgacagccaaggtgatgacttacgcattaccagatcatggtggaagcttgtggatggcgataaacaggctcgccatggcaccggctacg
gtaccagccatcacaaaggcgatctgcaagggtcattgactcgtggtgattacattcaatcgctggcgtaatgccatttggctaaccgctgatt
ttgaatctattccgggtggagggaacaagaccattggcgggacaggcttgatgtacaggctactttgccagtactattcaagatagacctcgct
ttggcaggttagaacaagcccgtagctgtggtgaaaaggcacacgcgaaaggcttgatgtcttcttggatggagtatttggcaccataaaggc
aatgtggtgccatcaccacaaggttagactgcctgtcggtgaaaataacccggtcagctaccagagagcctggcggtttacgaagaagtcgcc
agttactgggtgaaagagttaagattgatgctggcgctcgtgatcaagcctatcaagtgcgaccgatgcagaaagcgatccgtcagagc
gttgatgaagcgctcacagtccttaacttatgtaataacaaaggggaaaccgtccatccttgggttacatgggtgctgaaatttgaataacgaa
cgttacatcacagaaaccggttacggcaaaagggcgatccggcggttgctcggcttttgatttccgatgcgttccgagtggtcgaaacctt
gcggttaacgaaagtgtgtcagccgaaaaggcgcggaatggttgatgacggcatgtcactgcacagtcagtatccggatcatgccaaacct
aatatgttgggcaaccatgatgtggtgcgcttggggatctgctgcaacgtggcggtattgcgtcaccagaacaaccgcaatactggcagcg
tcataaagcgcgatgtcttcttagcagcgatataccggcccaattaccttgattacggtgaagaaattggcgatcaggttgacggcttgcataa
aaaatcaaagaagattgtgccgttattggttgtgatgaccacgtggcgcgaccagtgcgaaagattgatggcggtacggcgctcactgaatg
cacagcagtcgaactcaaaagtatatgtcttcttattgatgacattacgtcagcaacatcctgcgttatcacaaaggggaacgtactaatgtgatggc
gacagagacagtatacgtagaccataaacaggcagacaatgaagccctgttgatcatggtgagtacgactgataacgcggagtcagtcacctt
gaagggcaaagcgattggttcacaaggtgtgctgattgatttgaacgaacgagcggtttatgcccaataatggggagtagtccattccattaac
gggcttggcgacgattcctcaagattgacactccgacagcgcggtgtgatggcgcaatctgctgcctcggtatcgtagtagtggaagg
gatcatggcccaatgtgatacccaaccgtgaaggcaccgggtcgtagcagaacacctgtacgtggttggcgatttggcgatgctggttga
agcaaaagccgcagcgcggtatcaatacaaaaggcaagcacaatggcagcaactgtatcaagtgtgtgatgaaaagcgggcgccctac
aagatgaatacggcacgaaagattggagccacagttactgcagacggatggcattgaagccgggtaccgcaagtcgctcatagcgggt
ggctacggtaagacaccgctgacgttgcgggaatccggtaagtgtgtggagcttaacattcagtgatcttggcgagccggagcaaatc
atggtgtctaagtgtcagtaa

SEQ ID NO: 202

Met Thr Ala Lys Ala Asp Asp Leu Arg Ile Tyr Gln Ile Met Val Glu Ser Phe Val Asp Gly Asp Lys
Gln Val Gly His Gly Thr Gly Tyr Gly Thr Ser His His Lys Gly Asp Leu Gln Gly Ile Ile Asp Ser
Leu Asp Tyr Ile Gln Ser Leu Gly Val Asn Ala Ile Trp Leu Thr Pro Ile Phe Glu Ser Ile Pro Val Glu
Gly Gln Asp His Trp Ala Asp Arg Leu Asp Ala Thr Gly Tyr Phe Ala Ser Asp Tyr Phe Lys Ile Asp
Pro Arg Phe Gly Thr Leu Glu Gln Ala Arg Glu Leu Val Glu Lys Ala His Ala Lys Gly Leu Tyr Val
Phe Phe Asp Gly Val Phe Gly His His Lys Gly Asn Val Val Pro Ser Pro Gln Gly Arg Leu Pro Val
Gly Glu Asn Asn Pro Val Ser Tyr Pro Glu Ser Leu Ala Phe Tyr Glu Glu Val Ala Ser Tyr Trp Val
Lys Glu Leu Lys Ile Asp Gly Trp Arg Leu Asp Gln Ala Tyr Gln Val Pro Thr Asp Ala Trp Lys Ala
Ile Arg Gln Ser Val Asp Glu Ala Ser Gln Ser Val Thr Tyr Val Asn Asn Lys Gly Glu Thr Val His
Pro Leu Gly Tyr Met Val Ala Glu Ile Trp Asn Asn Glu Arg Tyr Ile Thr Glu Thr Gly Tyr Gly Lys
Glu Gly Asp Pro Ala Leu Cys Ser Ala Phe Asp Phe Pro Met Arg Phe Arg Val Val Glu Thr Phe Ala
Val Asn Glu Ser Gly Val Ser Arg Lys Gly Gly Glu Trp Leu Asn Asp Gly Met Ser Leu His Ser Gln
Tyr Pro Asp His Ala Lys Pro Asn Leu Met Leu Gly Asn His Asp Val Val Arg Phe Gly Asp Leu
Leu Gln Arg Gly Gly Ile Ala Ser Pro Glu Gln Pro Gln Tyr Trp Gln Arg His Lys Ala Ala Met Ser
Phe Leu Ala Ala Tyr Thr Gly Pro Ile Thr Leu Tyr Tyr Gly Glu Glu Ile Gly Asp Gln Val Asp Gly
Phe Ala Lys Lys Ile Lys Glu Asp Cys Ala Val Ile Gly Leu Cys Asp Asp His Val Ala Arg Thr Ser
Ala Lys Ile Asp Gly Val Thr Ala Ser Leu Asn Ala Gln Gln Ser Glu Leu Lys Val Tyr Val Ser Ser
Leu Met Thr Leu Arg Gln Gln His Pro Ala Leu Ser Gln Gly Glu Arg Thr Asn Val Met Ala Thr Glu

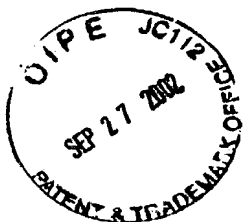


Figure 16HHHH

Thr Val Tyr Val Asf His Lys Gln Ala Asp Asn Glu Ala Leu Leu Tyr Met Val Ser Thr Thr Asp Asn
Ala Glu Ser Val Thr Leu Lys Gly Lys Ala Ile Gly Ser Gln Gly Val Leu Ile Asp Leu Leu Thr Asn
Glu Arg Phe Met Pro Asn Asn Gly Glu Tyr Ala Ile Pro Leu Thr Gly Phe Gly Ala Arg Phe Leu Lys
Ile Asp Thr Pro Thr Ala Ala Gly Val Met Ala Gln Ser Ala Ala Ser Val Ser Leu Val Gly Glu Gly Ile
Met Ala Gln Cys Asp Thr Pro Thr Val Glu Gly Thr Gly Pro Val Ala Glu Thr Leu Tyr Val Val Gly
Asp Phe Ala Asp Ala Gly Trp Lys Gln Lys Pro Gln Arg Ala Tyr Gln Tyr Lys Gly Lys His Asn Gly
Ser Asn Leu Tyr Gln Val Val Val Asp Glu Lys Ala Gly Ala Tyr Lys Met Gln Tyr Ala Thr Lys Asp
Trp Ser Pro Gln Phe Thr Ala Asp Gly Met Ala Leu Lys Pro Gly Thr Ala Lys Ser Leu Ile Ala Gly
Gly Tyr Gly Lys Asp Thr Ala Val Thr Leu Pro Glu Ser Gly Lys Tyr Val Trp Ser Leu Thr Phe Ser
Asp Leu Gly Glu Pro Glu Gln Ile

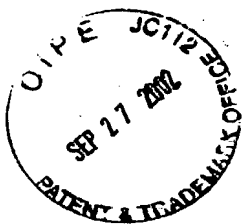
SEQ ID NO: 203

atgaagatgaagtcggcggtgttaggtagtgagtgagtgccatggcggtggcctcttcggcagccaatgccggtgcatggtcacctgtt
ccagtggagtgacaatgacatcgccaacgagtgcaaaaagggtgctcgggtcccaagggtatgaagcagtgagatcacgccgctgtgaa
cacctgcaaggctcctcctggtgggtggtctatcagccgctcagctacaagaacttcacttctctggcggtaacgaggccgaactcaaaagca
tgatgcccgttgcaaggccgcccgggtcaagatttacgccgatgcggtattcaaccagctggctggtgatcaggcgtcggtacaggtgta
gcagctacaatgccggcagcttcagctatcccaatttggtacaacgatttccatcacgctgggagcctcaccaactatgccaccgcaacaa
tgtcaaaaagggtgcctgctggggctgccggtatggtatccggctctgctatgtgcaggatcagctggctacatatgaagacctgagt
ggctgggggtgagcaggtttctgcttgatgcagcaaacatgatgagcgttgccgatctctggccatcgtcagcaaggcgggcaatcctttgt
ctactccgaggtgattggtgccacgggtgaaccaatccagccggcggaatataccggcattggtgctgacgaatttaataacggcaccga
tctggcctcaactcaaggggcagatcaagaatctcaagagcatggcgagagctgggggtgctgctgcgcgaacaaggctgaagtctttgtg
gtcaacatgacgtgagcggggacatggcggtggcggtatgctgacctacaaggatggtgccctctacaatctggccaacatctcatgctg
gcctggccctatggcgccatccccaggtgatgtccggctatgattcggcaccataccgatattggtggcgagcgtacccctgttcttcc
ggctctagctggaactgcgaacacggctggagcaacatcgccaacatggtctcgttccacaatgccgcccaggcagctccatgaccaactg
gtgggataatgtaataaccagatcgctttggtcgccgcccgaaggcctttgtggtgatcaacaatgaatcttccactctgagcaagagcctgc
agacgggtctgccagccggggagtgactgcaacattctgcccgggtgatccctgtgcagcggcagcaccatcaaggtgatgccagcggtat
ggccacctcaacgtggcagggatgaaggcggcagcagatccatcaatgccaaagccgatagcaccagcagtggtgagctcaggtcttctc
ctggtctcttctctctgccaccagtaacaagtttgccagcatgaatctgcggggcaccacaatggctggggcagcaccgccatgacagtga
tgccaacgtgtctggtcgccgatgtcacctttaccggggcgccggtatgccaatggtgccagcgcttcaagtttgatgtctatggcaactgg
acagagagctatggcgatacacaagccgatggcattggcgacaaggggagcgccaaggacatctattcaatggtgtgggcaagtatcgtgtc
tcgctcaaggagagcgacatgagctacacctgacctagctcagcaatcaggcaccgggtggcgccatcaccccaagacactctccgt
caagctgggtgactcagtggtgttcgatgctccggctccaccgatgatgtgggtgactggtacagctggtctaccggtggcagtgccaag
accgaaactgtgctgtttgatgctctgggtaccaagaccattaccgtgacagtggccgatgccgatggcttaccctcaaggccagtgccaccg
tcaccgtcaccgatggcagcgtggcttataacagcaactttgccagcctgaacttccgtggcactcccaacagttggggcgccgagccatga
cgctggtggcagacaacacctgggaggcaacgggtcaacttcgatggtcaggccaatcagcgcttcaagttcgatataaggggtgactggagc
cagaactatggtgatagcaacaaggatggggtggccgaacgtaccggtgccgatatttacaccactgtgaccgggtcaatataaggtgcaattta
acgactccactttgaagtacacctgaccaagctggccgatagcagcgccaccagctatagcgcgaactttgccagcctctacctgctggca
ccccgaacagctggggcaccaccgcatgaagctggtggccaataacagctggcaggccgaggtgaccttaccggcaagggcgatgcc
ctggtgcccacgcttcaagttcgacgtcaaggggtgactggagccagaactacggtgacagcaacatggacgggactggccaacggactgg
tggcgatatcaccagtgccgtggtgggcacatctggtgaccttataagacagcacactgaaatacacctgaccgccaataa

SEQ ID NO: 204

Met Lys Met Lys Ser Arg Ala Trp Leu Leu Gly Ser Ala Val Ala Met Ala Leu Ala Ser Ser Ala Ala
Asn Ala Gly Val Met Val His Leu Phe Gln Trp Lys Tyr Asn Asp Ile Ala Asn Glu Cys Glu Lys Val
Leu Gly Pro Lys Gly Tyr Glu Ala Val Gln Ile Thr Pro Pro Ala Glu His Leu Gln Gly Ser Ser Trp
Trp Val Val Tyr Gln Pro Val Ser Tyr Lys Asn Phe Thr Ser Leu Gly Gly Asn Glu Ala Glu Leu Lys
Ser Met Ile Ala Arg Cys Lys Ala Ala Gly Val Lys Ile Tyr Ala Asp Ala Val Phe Asn Gln Leu Ala
Gly Gly Ser Gly Val Gly Thr Gly Gly Ser Ser Tyr Asn Ala Gly Ser Phe Ser Tyr Pro Gln Phe Gly
Tyr Asn Asp Phe His His Ala Gly Ser Leu Thr Asn Tyr Ala Asp Arg Asn Asn Val Gln Asn Gly
Ala Leu Leu Gly Leu Pro Asp Leu Asp Thr Gly Ser Ala Tyr Val Gln Asp Gln Leu Ala Thr Tyr Met

Figure 16III

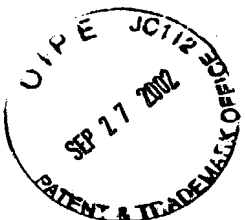


Lys Thr Leu Ser Gly Trp Gly Val Ala Gly Phe Arg Leu Asp Ala Ala Lys His Met Ser Val Ala Asp
Leu Ser Ala Ile Val Ser Lys Ala Gly Asn Pro Phe Val Tyr Ser Glu Val Ile Gly Ala Thr Gly Glu Pro
Ile Gln Pro Gly Glu Tyr Thr Gly Ile Gly Ala Val Thr Glu Phe Lys Tyr Gly Thr Asp Leu Ala Ser
Asn Phe Lys Gly Gln Ile Lys Asn Leu Lys Ser Met Gly Glu Ser Trp Gly Leu Leu Ala Ser Asn Lys
Ala Glu Val Phe Val Val Asn His Asp Arg Glu Arg Gly His Gly Gly Gly Gly Met Leu Thr Tyr Lys
Asp Gly Ala Leu Tyr Asn Leu Ala Asn Ile Phe Met Leu Ala Trp Pro Tyr Gly Ala Tyr Pro Gln Val
Met Ser Gly Tyr Asp Phe Gly Thr Asn Thr Asp Ile Gly Gly Pro Ser Ala Thr Pro Cys Ser Ser Gly
Ser Ser Trp Asn Cys Glu His Arg Trp Ser Asn Ile Ala Asn Met Val Ser Phe His Asn Ala Ala Gln
Gly Thr Ser Met Thr Asn Trp Trp Asp Asn Gly Asn Asn Gln Ile Ala Phe Gly Arg Gly Ala Lys Ala
Phe Val Val Ile Asn Asn Glu Ser Ser Thr Leu Ser Lys Ser Leu Gln Thr Gly Leu Pro Ala Gly Glu
Tyr Cys Asn Ile Leu Ala Gly Asp Ala Leu Cys Ser Gly Ser Thr Ile Lys Val Asp Ala Ser Gly Met
Ala Thr Phe Asn Val Ala Gly Met Lys Ala Ala Ala Ile His Ile Asn Ala Lys Pro Asp Ser Thr Ser
Ser Gly Ser Ser Gly Ser Ser Ser Gly Ser Ser Ser Ser Ala Thr Ser Asn Lys Phe Ala Ser Met Asn Leu
Arg Gly Thr Asn Asn Gly Trp Ala Ser Thr Ala Met Thr Val Asp Ala Asn Arg Val Trp Ser Ala Asp
Val Thr Phe Thr Gly Ala Ala Asp Ala Asn Gly Ala Gln Arg Phe Lys Phe Asp Val Tyr Gly Asn Trp
Thr Glu Ser Tyr Gly Asp Thr Gln Ala Asp Gly Ile Ala Asp Lys Gly Ser Ala Lys Asp Ile Tyr Phe
Asn Gly Val Gly Lys Tyr Arg Val Ser Leu Lys Glu Ser Asp Met Ser Tyr Thr Leu Thr Gln Leu Ser
Ser Asn Gln Ala Pro Val Ala Ala Ile Thr Pro Lys Thr Leu Ser Val Lys Leu Gly Asp Ser Val Val
Phe Asp Ala Ser Gly Ser Thr Asp Asp Val Gly Val Thr Gly Tyr Ser Trp Ser Thr Gly Gly Ser Ala
Lys Thr Glu Thr Val Leu Phe Asp Ala Leu Gly Thr Lys Thr Ile Thr Val Thr Val Ala Asp Ala Asp
Gly Leu Thr Ser Lys Ala Ser Ala Thr Val Thr Val Thr Asp Gly Ser Val Ala Tyr Asn Ser Asn Phe
Ala Ser Leu Asn Phe Arg Gly Thr Pro Asn Ser Trp Gly Ala Ala Ala Met Thr Leu Val Ala Asp Asn
Thr Trp Glu Ala Thr Val Asn Phe Asp Gly Gln Ala Asn Gln Arg Phe Lys Phe Asp Ile Lys Gly Asp
Trp Ser Gln Asn Tyr Gly Asp Ser Asn Lys Asp Gly Val Ala Glu Arg Thr Gly Ala Asp Ile Tyr Thr
Thr Val Thr Gly Gln Tyr Lys Val Gln Phe Asn Asp Ser Thr Leu Lys Tyr Thr Leu Thr Lys Leu Ala
Asp Ser Ser Ala Thr Ser Tyr Ser Ala Asn Phe Ala Ser Leu Tyr Leu Arg Gly Thr Pro Asn Ser Trp
Gly Thr Thr Ala Met Lys Leu Val Ala Asn Asn Ser Trp Gln Ala Glu Val Thr Phe Thr Gly Lys Gly
Asp Ala Thr Gly Ala Gln Arg Phe Lys Phe Asp Val Lys Gly Asp Trp Ser Gln Asn Tyr Gly Asp Ser
Asn Met Asp Gly Thr Ala Glu Arg Thr Gly Gly Asp Ile Thr Ser Ala Val Val Gly Thr Tyr Leu Val
Thr Phe Asn Asp Ser Thr Leu Lys Tyr Thr Leu Thr Ala Lys

SEQ ID NO: 205

atgtaccgcgtaatacctattattttgattatgagtatgatttagcttgtgagtcctccaaagaaaaaacaaccgaaaccgctcaaccttcaacaaa
tgccgaaaaaccctttgtttgggagcgtgccaatgtatatattttgttaactgaccgtttaacaacggtaaccgaaacaatgacatcaatttaaatag
gactaaagaatcaggaaaactccgcaattttatgggagcgatatacaggcatcacccaaaaataatgagggtatttttagtaaaactaggc
gttaatgccatctggttaccctgggttgaacaaatacatggcagtggtgatgaagggtaccggcaatacctatgcctttcatggttattggcca
aagattggacaaacttagacccaattttggcacaagaagacctggccgaactggtgcaactgccccatgcaaaaggcatcaggatactttta
gatgtgtaataaaccacaccggcccggttaaccgaccaagacccggtttggggagaagattgggtacgtacaggccccgagtgatctatga
taattacaccaataccaccagttgcacgctggtgaccaatttacctgatatacttacagaagtaataatgtggccttaccacctttttgttaga
taaatggaaagccgaaggcagattagagcaagaactaaaagaacttgacgattttttcccgcacaggccaccacgcgcaccccgcttttac
attattaaatggcttaccgattacatccgagaatttgggtagatgggttaggggtgataccgtaaaacataccgaagaacgggttggccgag
ttgatgatgaagccgtaattgcttttggcgaatataaaaaagccaaccagacaaggtattggacgataatgaatttatatggtaggcgaagtgt
acaactacgggtatttccggcggaaggttctatgatttcggcgataaaaaggtggactattttgaccacggatttaaaagcctcatcaattttgaaatg
aaatatgatgccaattttacctacgatacacttttaggaagtacgataccctttgcatacaaacttaaggcagaagtgtgctcaactacctctca
tctcacgacgatggaagtccatttgataaaatcgggcaaaaaccatacagatcggtacaaaattactgctcactccggcgcatcccaatttat
tacggtgacgaaccgccagaagccttaacatagaaggcgacagggagatgctacgcttcggttgattgaattgggaagagctcgagaa
gacctgccaagcaaaaaatacttcagcattggcaaaaactggcgagtttcagggaacaaccaccccgagttggtgccggaaggcacaacaa
ccttggaacaaagccgttttacaccttttagcagggtttatcaaaaaatggttttattgacaaagttgtgtagcattagatgccccaaaggccaaa
aacaattaccggttaattggtgttttgatgacggtaacaaaactgtagatgcctattcaggcaagaacccagttaaaaatggtatcgtttcacttt
ctctgaatttgatattgtttgttagaacaacaaataa

Figure 16JJJJ



SEQ ID NO: 206

Met Tyr Arg Val Ile Pro Ile Ile Leu Ile Met Ser Met Ile Val Ala Cys Glu Ser Pro Lys Lys Lys Thr
Thr Glu Thr Ala Gln Pro Ser Thr Asn Ala Glu Lys Pro Phe Val Trp Glu Ala Ala Asn Val Tyr Phe
Leu Leu Thr Asp Arg Phe Asn Asn Gly Asn Pro Asn Asn Asp Ile Asn Phe Asn Arg Thr Lys Glu
Ser Gly Lys Leu Arg Asn Phe Met Gly Gly Asp Ile Lys Gly Ile Thr Gln Lys Ile Asn Glu Gly Tyr
Phe Ser Lys Leu Gly Val Asn Ala Ile Trp Leu Thr Pro Val Val Glu Gln Ile His Gly Ser Val Asp
Glu Gly Thr Gly Asn Thr Tyr Ala Phe His Gly Tyr Trp Ala Lys Asp Trp Thr Asn Leu Asp Pro Asn
Phe Gly Thr Lys Glu Asp Leu Ala Glu Leu Val Ala Thr Ala His Ala Lys Gly Ile Arg Ile Leu Leu
Asp Val Val Ile Asn His Thr Gly Pro Val Thr Asp Gln Asp Pro Val Trp Gly Glu Asp Trp Val Arg
Thr Gly Pro Gln Cys Thr Tyr Asp Asn Tyr Thr Asn Thr Thr Ser Cys Thr Leu Val Ala Asn Leu Pro
Asp Ile Leu Thr Glu Ser Asn Glu Asn Val Ala Leu Pro Thr Phe Leu Leu Asp Lys Trp Lys Ala Glu
Gly Arg Leu Glu Gln Glu Leu Lys Glu Leu Asp Asp Phe Phe Ser Arg Thr Gly His Pro Arg Ala Pro
Arg Phe Tyr Ile Ile Lys Trp Leu Thr Asp Tyr Ile Arg Glu Phe Gly Val Asp Gly Phe Arg Val Asp
Thr Val Lys His Thr Glu Glu Thr Val Trp Ala Glu Leu Tyr Asp Glu Ala Val Ile Ala Phe Ala Glu
Tyr Lys Lys Ala Asn Pro Asp Lys Val Leu Asp Asp Asn Glu Phe Tyr Met Val Gly Glu Val Tyr
Asn Tyr Gly Ile Ser Gly Gly Arg Phe Tyr Asp Phe Gly Asp Lys Lys Val Asp Tyr Phe Asp His Gly
Phe Lys Ser Leu Ile Asn Phe Glu Met Lys Tyr Asp Ala Asn Phe Thr Tyr Asp Thr Leu Phe Arg Lys
Tyr Asp Thr Leu Leu His Thr Lys Leu Lys Gly Arg Ser Val Leu Asn Tyr Leu Ser Ser His Asp Asp
Gly Ser Pro Phe Asp Lys Met Arg Gln Lys Pro Tyr Glu Ser Ala Thr Lys Leu Leu Leu Thr Pro Gly
Ala Ser Gln Ile Tyr Tyr Gly Asp Glu Thr Ala Arg Ser Leu Asn Ile Glu Gly Ala Gln Gly Asp Ala
Thr Leu Arg Ser Phe Met Asn Trp Glu Glu Leu Ala Glu Asp Pro Ala Lys Gln Lys Ile Leu Gln His
Trp Gln Lys Leu Gly Ser Phe Arg Asn Asn His Pro Ala Val Gly Ala Gly Arg His Lys Thr Leu Gly
Lys Lys Pro Phe Tyr Thr Phe Ser Arg Val Tyr Gln Lys Asn Gly Phe Ile Asp Lys Val Val Val Ala
Leu Asp Ala Pro Lys Gly Gln Lys Gln Ile Thr Val Asn Gly Val Phe Asp Asp Gly Thr Lys Leu Val
Asp Ala Tyr Ser Gly Lys Glu Thr Ser Val Lys Asn Gly Ile Val Ser Leu Ser Ser Glu Phe Asp Ile
Val Leu Leu Glu Gln Lys

SEQ ID NO: 207

ctgtcgactgagcctttcgttttgggctcgagactgactctcagccacccccgcagtagctccagacggagtagccgtaatagccgttgccggg
gtcgtgggcaggggccctcgaggtacacccacccgcttgagtcacccacttgccacccagccgccgaggttgccggtgactcgtggatgc
acgctcccgcaacttcggaacgtagaccaccttccggttcttgaggcagaggtgatgtatgttatcagtcgccgcttgcctccgtagccgt
ttctcacgaatatcagctcgtcgttgcgtagtaaacgacgtcagtgcttctccggccaggttgatgtatccagatgaggttcttgagcttatcct
tgttgagccactcctcgtagtcgcgtagaataattgctggctggccctcgtaggtgaggtgaacgcgtaggtcgtgatactgttccagattat
cggtgtcgtggtttgcaacgaaggttacggcctaaacgggtcgcggctgacactgtgccccgttcttgaggccctcgacagtgccggaa
tgttctgttgcaaggccgctccatctttagtagagcgggaagtcgaagaccttgccgcccgtcagtagggccaggttgaggagtgatc
aacgttggtgtccagtagtcccaacggccagccgccccaccagttgagccagtccttgacgacccagctccgtgccccttcacgtatgc
aaagcgccaggcatcaacgccgatgtccttaggttagggcggtagctctcatcgtcgcgagagccagtgctggtccagctcttctcgtg
ggctatgtctgggaagcctccaaatgtgcctcgtcacagcacttgacctggtgggtggaagtcgaggtagttggcagtatatttcccagg
ccaccttgagaagtcggtccaggttagtcccaacgaacgggtccactcgaggtctccgctgcggtgtttatgacgatgtccgctatg
accttatgccgtaggcatggggtgtttatcatgttcacgagctcctgcttgagccaaagcgcgtctaccgttcccttctggtcgtactacc
gaggtcaaagaagtcgtaggggtcgtagccatcgaataggcgcgcccagtccttgctgcgcccggggaatccaaatggcggtatattccc
cctctaccactcgggtatcttgcctgatggtgtccaccagattcctccacctgggacgtccagtagaaggcctgcattataacgccgcct
ctccagctcggagtacttgccataagttacctctactagtagtataaaa

SEQ ID NO: 208

Leu Ser Thr Glu Pro Phe Val Leu Gly Ser Arg Leu Thr Leu Ser Pro Pro Arg Ser Ser Ser Arg Arg
Ser Ser Arg Asn Ser Arg Trp Pro Gly Arg Gly Gln Gly Pro Arg Gly Thr Pro Thr Arg Leu Ser Pro
Pro Thr Cys Pro Pro Ser Arg Arg Gly Cys Arg Cys Thr Arg Gly Cys Thr Leu Pro Arg Thr Ser Glu
Arg Arg Pro Thr Phe Arg Leu Cys Leu Arg Arg Gly Cys Met Leu Ser Val Pro Ala Cys Phe Arg



Figure 16KKKK

Ser Arg Phe Ser Arg Ile Ser Ala Arg Arg Cys Arg Ser Lys Arg Arg Gln Cys Phe Leu Arg Pro Gly
Cys His Val Ser Arg Gly Ser Ala Tyr Pro Cys Ala Thr Pro Arg Ser Arg Gly Arg Ile Leu Ser Ala
Gly Pro Arg Arg Gly Thr Arg Arg Leu Asp Thr Cys Ser Arg Leu Tyr Arg Cys Arg Gly Leu Gln
Arg Arg Leu Arg Pro Thr Gly Arg Gly Arg Leu Cys Pro Arg Ser Gly Pro Arg Arg Val Arg Glu
Cys Ser Cys Cys Gln Arg Pro Arg Pro Ser Cys Ser Arg Ala Gly Ser Arg Arg Pro Trp Arg Arg Ser
Ser Arg Pro Ser Gly Val His Gln Arg Trp Cys Pro Ser Thr Arg Gln Arg Pro Ser Arg Pro Thr Ser
Ala Ser Pro Arg Pro Thr Leu Arg Gly Pro Ser Arg Ser Gln Ser Ala Arg His Gln Arg Arg Cys Ser
Leu Gly Arg Arg Arg Ser Ser His Arg Ser Pro Arg Ala Ser Ala Gly Pro Ser Ser Ser Arg Gly Leu
Cys Leu Gly Ser Leu Gln Met Cys Pro Arg His Ser Thr Pro Arg Trp Gly Gly Ser Arg Gly Ser Trp
Gln Tyr Ile Cys Pro Arg Pro Pro Leu Arg Ser Pro Ser Arg Cys Ser Pro Gln Arg Thr Gly Ser Thr
Arg Gly Leu Arg Leu Arg Gly Gly Leu Arg Cys Pro Leu Pro Leu Cys Arg Arg His Gly Pro Cys
Leu Ser Cys Ser Arg Ala Pro Ala Trp Ser Gln Ser Ala Ser Leu Pro Phe Pro Ser Gly Arg Thr His
Arg Gly Gln Arg Ser Arg Arg Gly Arg Ser Pro Ser Asn Arg Arg Arg Pro Cys Pro Cys Ser Pro Gly
Glu Ser Lys Trp Arg Ile Phe Pro Pro Arg Thr Thr Pro Val Ser Cys Ser Trp Cys Pro Thr Arg Phe
Leu His Leu Gly Arg Pro Ser Arg Arg Pro Ala Leu Arg Arg Pro Leu Pro Ala Arg Ser Thr Trp Pro
Val Thr Ser Tyr Ile Lys

SEQ ID NO: 209

atgattcagcccatgcactctcggaacaggcctgccgtctcattccggcactgatcatgacattgcactggcactgccgttgcaaattcgtgccg
atgtcacctgcattgcttcaactggagctatgccgatgtcgtgatcgccggttgacatcgctgcagcagggtacagtcccgctgtgtggccc
cgccacttcgatccgaagcacggcctggtggcgcgataccagccccaggatctccgccttatcgaccatccgctgggcaatacacatgacttc
gtcaacatgatgatgctctgatgatgtgggtgtggcggtgtacgccgacatcgtgtcaaccacatggccaatgaggctgcacaaaggcctga
cctgaactaccctggtcaggcagtgcttgacgaatatgctccgatcccggtcatttcgagggcttgaggctgttcggtaatctgagcttcaatttct
gtcggacatgatttcggaccgccccagtgatcattcaggattacagcgatgtgttcagggtccagaactggcggtgtgcggaccgcccgccgacc
cgggctgccccgacctggtcgccaatgactgggtgatctcacaacagcgccagtgatctggaagccatcaaggcgctgggtgtggttgatcg
catcgacgggtcaagcatatgccccatgagccataatgccgttccacccccgagatccggctgggctgcatgtgttggcggaagtcacacc
tccggtgggctggtgatacctacgaccgttttctggccccttacctggcacaaagcgacatggtgcctatgactttccattgtttgaaaccatt
cgccgtgctttcggttcggtggcagcatgagtgaactggcgatcctgctgctacggtcaggccctgccaccggaccgcgccatcaccttcgtc
atcacgcacgatattccgaacaatgacggatttcgctaccagatactgacccccgctgatgaatcactggcctacgcctacattctgggccgcatg
gcggtgtcccgttctgtattccgacaacaatgaaagcgcgatggccgctggatcgtgctggcaacgtccggatctggttgcaatggtcggt
tccacaatgcagtcacggcagcatggcgtgctttcacatgacgactgccacctgctgttccggcgcgagcctcggtgattgctggcatca
acaagtgcggccatgcactcagctcctgggtcaacatgaaccagagcgctactgtggtgtacgcggactacacagacgtgctcgacagcaacag
cgttgtcaacatccagtcacctggcacgagttcatccttcccgccccgaccgacgcctgtggttgcca

SEQ ID NO: 210

MIQPMHSREQACRLIPALIMTFALALPLQIRADVTLHAFNWSYADVADRAVDIAAAGYSA
VLVAPPLRSEGTAWWARYQPQDLRLIDHPLGNTHDFVNMIDALDDVGVGVYADIVLNHM
ANEAARPDLPDLNYPGQAVLDEYASDPGHFEGLRLFGNLSFNFLSEHDFGPAQCIQDYSDVF
QVQNWRLCGPPDPGLPDLVANDWVISQQRQYLEAIKALGVAGMRIDAVKHMPSHINA
VLTPEIRSLGHVFGVITSGGAGDTSYDRFLAPYLAQSDHGA YDFPLFETIRRAF GFGG SMS
ELVDPAAYGQALPPDRAITFVITHDIPNNDGFRYQILD PVDESLAYAYILGRDGGVPLLYSD
NNESGDGRWIDAWQRPDLVAMVGFHNAVHGDMAVL SHDDCHLLFRGSLGIVGINKC
GHALSSWVNMNQS VLVWYADYTDVLDSNSV VNIQSSWHEFILPARQARLWLR

SEQ ID NO: 211

GTGTTTCGTTCTGACACAGTTTCGCGTACCTGCATGTATGGTGCGCTGCGTAATGCCTA
CCAACCCGATCGGGTGTCTTACTGGAGTCACGGTGCGGACATGCAACTTAAAAAAGCAT
GCTCATCGCCAGGCGCTGTTGTTTCATCGTGACGCGGTGCCTGTGCCTGAAATCCAGGC
AGACCCATAAAAAACAACAACAAACCGATAACAAACGACCCAAGCCTTCTAAGAGGAG
AAAACGGGATGGCTTTTAAACTACGAAAAAGGCGCTCGTTGGCCTGTTACGGCCGG

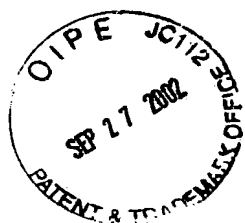


Figure 16LLLL

CGCAATGGTATATGCCGGTGCAGCGGCGAGTGGTGAAATCATTCTGCAGGGCTTCCAC
TGGCACTCCAAGTGGGGCGGCAACAATCAGGGTTGGTGGCAGGTGATGGAAGGTCAG
GCCAACACCATCGCCAACGCCGGCTTTACGCACGTGTGGTTCCCGCCGGTCCATAACT
CGGCCGATGCCGAGGGTTACCTACCCCGCGAGCTGAACAACCTCAACTCCAGCTATGG
CTCCGAAGCACAGCTGCGCAGCGCCATCCAGGCACTGAACAATCGCGGCGTGCATGCG
ATTGCCGATGTGGTCATGAACCACCGGGTGGGCTGCTCTGGCTGGGCGGATTTCTGTA
ACCCGGACTGGCCGACCTGGTACATCGTCGCCAATGATTCCTGGCCCCGGTGGCCCCGAA
AAGCCAGAACTGGGACACGGGTGAGACGTACCACGCCGCCCGTGACCTCGATCACGC
CAATCCGCAGGTGCGCAACGATATCTCGCACTACCTGAACAGCCGCCTCAAGGACGTC
GGCTTCTCCGGCTGGCGCTGGGACTATGCCAAGGGTTTCTGGCCCCGGCTATGTCGGCG
AGTACAACTGGAACACCAACCCGAACTTCTGTGTGGGTGAGGTGTGGGACGATCTCGA
CCCCAACAATCCCAACCCGCACCGCCAGCAACTGGTGGACTGGGTTGATGCTACCGGT
GGCAGTTGTACGTCCTTCGACTTCACCACCAAGGGGCTGACGAACTATGCGCTGCAGC
ATGGCCAGTACTGGCGCCTGCAGGGTGATAATGGTGGCCCCGGCTGGCGGCATCGGCTG
GTGGCCGCAACGCATGGTGACCTTCGTCGACAACCATGACACGGGCCCCGAGCAATCAC
TGTGGTGACGGCCAGAACCTCTGGCCCCGTGCCCTGTGACAAGGTCATGGAGGCGTATG
CCTACATCCTGACCCATCCGGGCGTGCCGTGCGGTGTACTGGACGCACTTCTTCAACTGG
AATCTTGGTAGCGAGATCAGCCAGTTGATGCAGATCCGCAAGAACCAGGGCGTGCCT
CCGGTCCGACGTCTGGATCGCCGAGGCCCCGTACGGCCTGTACGCCGCTATATCAA
CGGTAATGTGGCGATGAAGATGGGCTGGGATAACTGGAGCCCCGGGCTGGGGCTGGTC
GCTGGCGGCCTCCGGTAACAACCTGGGCCGTCTGGACACGCTGA

SEQ ID NO: 212

VFRSDTVSRTCMYGALRNAYQPDRVFTGVTVRTCNLKKHAHRQALLFIVTRCLCLKSRQT
HKNNNKPITNDPSLLRGENGMAFKLRKKALVGLFTAGAMVYAGAAASGEIILQGFHWHS
KWGGNNQGWVQVMQANTIANAGFTHVWFPPVHNSADAEGYLPRELNNLNSSYGSEA
QLRSAIQALNNRGVHAIADVMMNHRVGC SGWADFCNPDWPTWYIVANDSWPGGPKSQN
WDTGETYHAARDLDHANPQVRNDISHYLSRLKDVGFSGWRWDYAKGFWPGYVGEYN
WNTNPNFCVGEVWDDLDPNPNPNPHRQQLVDWVDATGGSCHVDFDFTTKGLTNYALQHGO
YWRLQGDNGGPAGGIGWWPQRMVTFVDNHD TGPSNHCGDGQNLWPVPCDKVMEAYA
YILTHPGVPSVYWTHFFNWNLGSEISQLMQIRKNQGVHSGSDVWIAEARHGLYAAAYINGN
VAMKMGWDNWSPGWGWSLAASGNNWAVWTR

Figure 16MMMM